Jan 1955 1955

Editorial

EACH year as we launch the calendar into a new procession of days and dates, most of us flip back over the sheets we have changed, look into the past, and wonder about the future.

For the New Year always commences in the shadow of the Old, something which is particularly true of 1955.

If nothing really startling happened in 1954 it was mainly because the stage was being set for more action to come.

The consolidation of the TV outlook I do not class as startling because it was an anti-climax and a rather dreary one at that. As a preparation for a major Australian industry it made little impression on the average man.

What will hit him with some force is the availability of the first programs and the first TV sets. Will this be in 1955?

I don't think so. It is more likely to be in 18 months or two years from now.

What has happened, however, is a great deal of behind-the-scenes planning, and the consolidation of capital interests who hope to secure TV commercial licences. As I anticipated, powerful group applications have been made by broadcasting stations and other interests and the issue of licences to some of them is one thing we can confidently expect this year.

I should say that by 1956 the general pattern of TV will be fairly clear, and plans to implement it will be well under way. Some time in 1957 we should see results.

I think, too, that the potential magnitude of TV operations is beginning to be better appreciated by many as they sit down and count up their requirements and possible responsibilities in terms of hard cash. These are so great that only those very large facilities can hope to succeed.

It seems fairly certain that, before long, regular FM stations bearing ABC programs will go into action, using the overhauled experimental transmitters in capital cities. Whether commercial stations will follow the lead it is hard to say, but I doubt whether they will do so in 1955.

No big sensations are indicated on a world scale, but plenty of mighty little things such as transistors and solar batteries will find their way into more and more standard equipment. There is no doubt that the international and electronic war will continue to unearth greater resources and spectacular achievements. If anything this war will intensify. It is part of the eternal vigilance which is the price of peace

John Moyle

INDEX

rials For Aircraft	3	Experiments With Ultra-Linear	52
G Talking Clock	4	Here's Your Answer, Tom!	62
lephone Net Over USA	9	Let's Buy An Argument	64
rowave Aerial Testing	11	A Reader Built It	73
rrent Close-Up Of Science	13	Trade Notes And News	75
Lights That Save Lives	14	Calibrating Your R/C Bridge	76
hnical Review	19	Record Reviews	82
s and Views	25	Binaural Records Take A Bow	87
Miniature DX Set	28	Record News From Overseas	89
h Unit With Color	35	Short Wave Notes	90
Serviceman Who Tells	37	The Ham Bands	91
Microphone Amplifier	40	Answers To Correspondents	101
cking RF Oscillators	49		

RADIO AND HOBBIES IN AUSTRALIA

A NATIONAL MAGAZINE OF RADIO, HOBBIES AND POPULAR SCIENCE

EDITOR
JOHN MOYLE
S.M.I.R.E. (Aust.)

TECHNICAL EDITOR
NEVILLE WILLIAMS
M.I.R.E. (Aust.)

TECHNICAL STAFF
PHILIP WATSON
MERVYN HUDDLESTON
L. VARADY

Vol. 18, No. 8
" 16 " 10

SUBSCRIPTION
C'wealth, NZ, N. Guinea, Fiji—18/- pa
United Kingdom—£1/0/6 pa
S. Empire—£1/3/ pa
Foreign—£1/5/- pa

Published on the first Friday of each month by Associated Newspapers Ltd., 60-70 Elizabeth St., Sydney.

Phone B0333

OUR COVER PICTURE

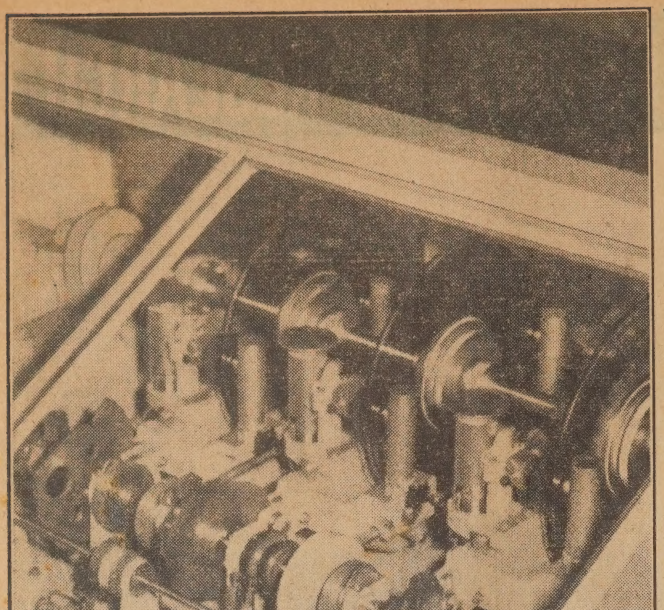
This inflatable rubber raft used for fire fighting in England carries three powerful motor pumps, one of which supplies "jet propulsion" and and steering. Would have been invaluable in the last war, and handles 1000 gallons per minute.

Digitized by the Internet Archive
in 2024 with funding from
Amateur Radio Digital Communications, Grant 151

https://archive.org/details/radiohobbiesinau1610unse

MODEL HELPS AERIAL RESEARCH

Aerial experimental work to develop arrays for aircraft is carried out by the Californian Research Institute which specialises in micro-wave investigations. An aerial installation on one of the mountain peaks in the background is used in conjunction with the model so that the conditions of free flight are approximated. The mounting of the model on its platform helps to remove it as far as possible from ground influences when making aerial impedance measurements—see story on page 9.



This is a picture of the main portion of the speaking mechanism. The three discs which carry the time announcements can be seen in the background, along with their respective exciter lamps (left) and photo-cells (right). In the foreground are the drive shafts and cams which adjust the optical systems to the required tracks.

operator gave the time, there was al accurate spring operated chron ometer for use in case of failure o the impulses from the observatory.

Now all this has been changed The new device provides a 24-hou service with a time signal every 1(seconds, accurate to within bette than 1/100 second. It can answe 100 subscribers simultaneously, an each subscriber remains connecte for one and half minutes; ample time for you to adjust your watch and check that you heard the announcement correctly.

CLEAR ANNOUNCEMENT

Actually there is little chance o you missing an announcement, ever the first time, because each is a clear and precise statement. Unlike the human operator this device never tires or becomes irritated with its monotonous job. As a result it never mumbles or garbles its announcements, never makes mistakes, and provides an extremely high degree of accuracy.

Other services which the clock provide, automatically, are a six-pip signal every minute to the Victorian Railways Department, a special (XNG) signal every three minutes over the coastal radio station VIM for the checking of ship's chronometers, and the one o'clock time signal sent daily to all post offices and various private subscribers.

And how is all this achieved? The complete mechanism is known, officially, as "The British Post Office Speaking Clock, Mark II", and was

PMG'S NEW TALKING CLOCK

Have you used your telephone for a time check recently? If you have and you live in Sydney or Melbourne you will have heard the time given by a pleasant male voice which repeats the information every 10 seconds. If you fe el inclined to sympathise with the operator about his monotonous task—don't, for you have been listening to the Australian Post Office's new talking clock.

UNTIL the advent of this new device the time service employed a number of operators who had the tedious job of announcing the time four times every minute. A series of one second impulses from the Observatory was used to operate an impulse clock and also a stepping switch which opened the operator's microphone and fed pips into the circuit in a regular sequence.

The operator could not hear any of the calling subscribers, her only indication that callers were waiting being an indicator lamp. While this light was on the time announcements would be given continuously. During peak hours it would be on permanently, handling up to 40 subscribers at one time.

At the commencement of a cycle the stepping switch would silence the microphone for three seconds, open it for four seconds for a time announcement, "correct at the next pip", close it for three seconds, open it for four seconds for another announcement, then close it for one second for the pip indicating the exact time. As well as the "call waiting" lamp there was also a "microphone on" light.

In addition to the observatory controlled impulse clock from which the designed and built by the Brit Post Office engineers. Cer additional equipment requeste the Australian authorities to er local requirements was also pr vided by the British engineers.

For purposes of explanation it easiest to think of the equipme as being in two separate sectio the actual clock section which is r sponsible for generating the act time impulses—and maintaini them within the prescribed tole ances—and talking section whi provides the announcement for subscriber.

The heart of the clock section

a 100 Kc quartz crystal. This is mounted in an oven and temperature controlled by means of a sensitive bridge thermostat, thyratron valves, and a heating element. As a result the frequency at which the crystal vibrates is held within very fine limits.

The actual frequency can, if necessary, be deliberately varied over a small range, thus providing a means of "regulating" the clock. However, once this is correctly set it should need no further adjustment.

FREQUENCY DIVIDERS

The 100 Kc signal from the crystal is then fed to a multi-vibrator type frequency divider which, over a number of stages, reduces the frequency from 100 Kc to 50 cps. Naturally, this 50 cps signal will have the same order of accuracy as that of the crystal circuit from which it is derived.

This signal is now fed to an amplifier consisting of a pentode driver, a triode phase changer, and a pair of 6V6's in a class A push-pull in the output. The 50 cps power from this amplifier can be used to drive a conventional synchronous electric clock, and in fact this is done to provide a rough check on the accuracy of the whole system. Two such clocks, operated from the main and standby units respectively, are mounted side by side, and it is impossible to detect any difference between them.

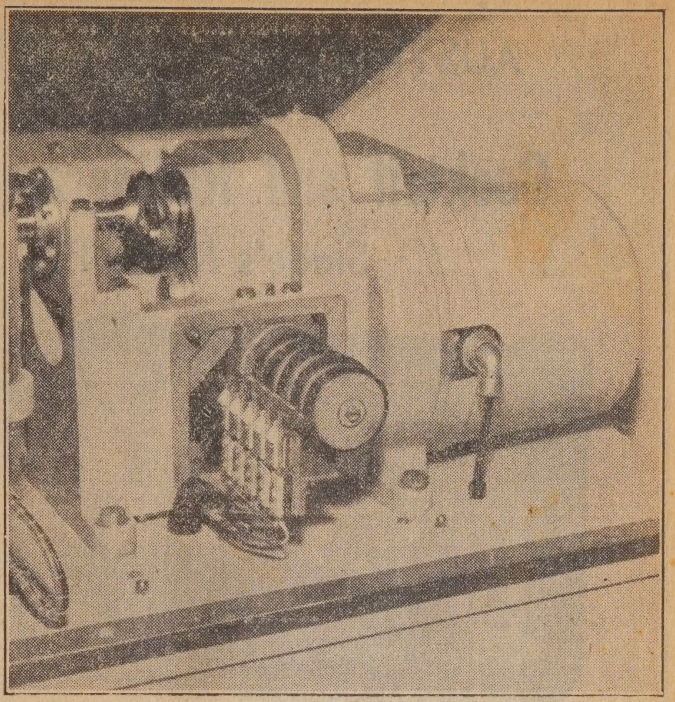
What might be regarded as the last section of the clock proper is a sonic motor which runs synchonously with the 50 cps power and drives a number of discs, one of which carries a 1000 cps pip every second and which lasts for 1/10 second. The correct time is referred to the commencement of the pip.

To ensure that a high degree of accuracy is maintained each clock is checked every 24 hours against even more accurate standards. One of these is a master clock, also a quartz crystal type, which is housed in the PMG Research Laboratories in Melbourne. Every morning one second impulses are sent out from this master clock over special trunk lines to both the Sydney and Melbourne talking clocks, and are compared with similar impulses generated by these latter. Accurate allowance is made for the time taken for the impulses to travel from Melbourne to Sydney.

CORRECTION

In the event of the impulses not corresponding, a special phase correcting mechanism is brought into operation which shifts the phase of the 50 cps power until it is correct. Naturally, such a system can only operate if the two clocks are accurate to within better than one second, since it can only compare the two impulses, but cannot identify them.

Normally the order of accuracy is much higher than this, the master pulse from Melbourne being used to control a local "gating" circuit which reproduces a pulse three milliseconds wide. (A millisecond is 1/1000 second.) Ideally, the pulse from the talking clock should occur exactly in the centre of this pulse, leaving a tolerance in either direction of one and a half milliseconds. If it varies from optimum by more than this amount, the two pulses will not coincide, and the phase correcting mechanism comes into circuit to make the necessary adjustment. At the same time a decade counter circuit operates to count the number of milliseconds of correction, and these are ticked up on a simple mechanical counter so that the order of correction may be observed.



A close-up of the sonic motor and the five cam-operated contacts which select the various recordings in the correct sequence to make a complete sentence. The cam nearest the camera selects the opening phrase and the far one selects the pips, the intermediate ones operate in logical sequence.

The usual order of correction would normally be less than 10 milliseconds. In fact, it is more usually between three and five milliseconds.

A double beam cathode ray oscilloscope is also provided and the impulses from both the master and talking clock may be displayed simultaneously, one above the other, and compared against an engraved scale having 1 millisecond divisions. Thus it is possible to check directly the approximate order of error.

As a final check the master clock in Melbourne is itself checked, this time against the standard at the Commonwealth Observatory in Canberra. As a result, the average accuracy of these clocks would be of the same order as the best observatory standards, while the instantaneous variation from this accuracy would be less than 10 milliseconds (1/100 second).

It should also be pointed out that the need to correct the clock to the observatory time does not necessarily indicate that the clock has drifted. Signals from the observatory can vary by quite appreciable amounts due, among other things, to variations in the rotational speed of the earth.

Having provided these highly accurate one second pulses it only remains to identify them by means of suitable announcements in order that they may be of use to the telephone subscriber. This is where the talking section of the clock takes over.

As already explained, a sonic motor drives a disc on which are recorded the one second pips used to indicate the exact time. On this same disc, and on two other discs mounted on the same shaft, are also recorded the actual time announcements.

RECORDING SYSTEM

The method of recording is rather novel. The discs are of glass and the recording is in the form of variable area photographic track similar to that used for motion picture recording. It is picked off by means of a photo cell and exciter lamp on opposite sides of each disc.

This scheme has the advantage that the recordings are not subject to wear as would occur with either mechanical discs or tape, and should thus retain their quality for an indefinite period. It also simplifies, to some extent, the selection of the various tracks as each is required.

The discs are approximately 13in in diameter and revolve at 30 rpm and, considering the width of even the narrowest practical photographic track, it is immediately obvious that continuous playing for a complete 12-hour period could not be accommodated on this amount of recording space.

This problem is overcome in a rather ingenious manner, and a total of 4320 announcements which would

AUSTRALIA'S FINEST SELECTION

Of

Cocktail and Radiogram Cabinets

Slade's Radio Pty. Ltd.

MODEL 508

Makes available to radio dealers and home constructors a full range of cocktail and radiogram cabinets. Made from best quality maple and Italian walnut veneers, finished with a brilliant piano finish.

Labyrinths available suitable for 12in speakers.

Let us Show you how Cheaply we can convert Your old Radio Set into a modern Radiogram

OR

Choose a new chassis from the following Models

3-SPEED GARRARD RECORD CHANGERS
NEW £12/12/-

Type No.			
510	5 Valve	D.W. 12in Speaker	£24/10/-
510 De Luxe	5 Valve	D.W. 12in Speaker .. .. .. Wide Range with Treble & Base boost.	£34/10/-
511	9 Valve	D.W. Wide Range .. .. .. P.P. 12in Speaker.	£34/10/-
512	11 Valve	F.M.A.M. Dual Wave .. .. Wide Range. 12in Speaker.	£47/10/-

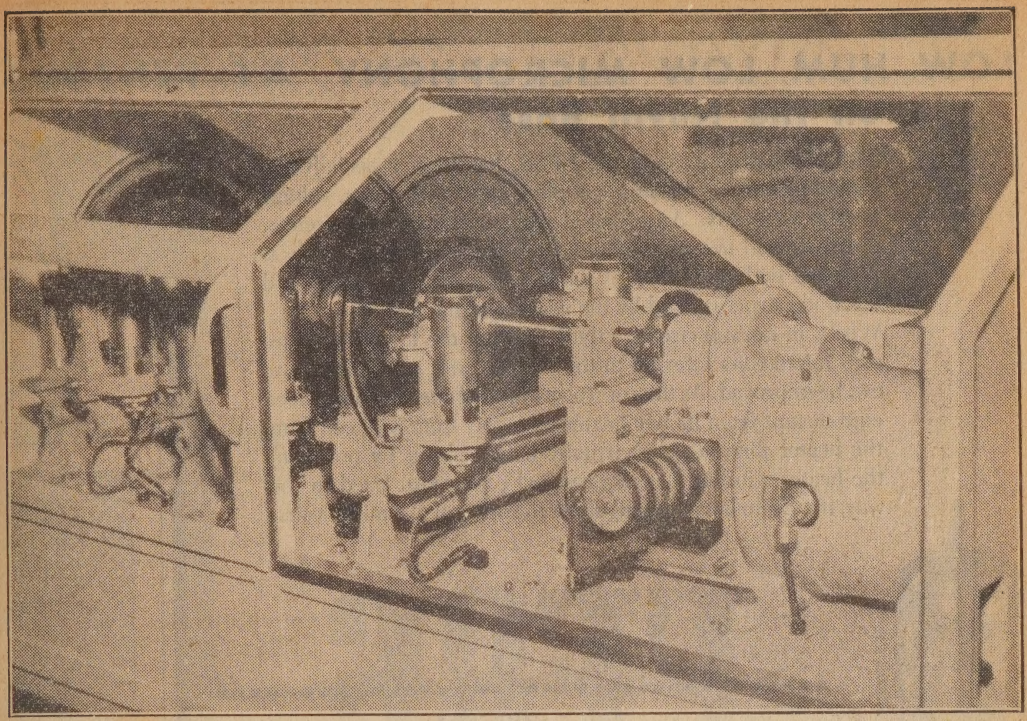
Daily Demonstrations of F.M. and Tape Recording at our Factory.

SLADE'S RADIO Pty., Ltd.

LANG ST., CROYDON, N.S.W.

TELEPHONE UJ5381-UJ5382

ESTABLISHED 30 YEARS



A rear view showing the sonic motor, the cam switches, and an excellent view of the discs. One of the exciter lamps is clearly visible in front of the nearest disc. The photo-cell housing is just visible through the disc.

be required for one announcement every 10 seconds for 12 hours has been reduced to only 94 announcements.

This has been done by breaking up the complete announcement into sections and providing a separate track for each section. By this means standard portions of the announcement can be repeated as often as may be necessary simply by continuing to scan the same track.

Thus the phrase "At the third stroke—" is scanned continuously, since it is common to all announcements. The next portion of the announcement "—it will be (and the hour)—" can be repeated for an hour and requires only 12 tracks for the complete 12-hour period.

Next comes the minute phrase, which is simply the figures from one to 59, plus, "o'clock" for the complete hour. Following this is the end of the announcement, "—and (so many) seconds". The word "precisely" is used to indicate each whole minute. This calls for only six tracks which are simply repeated every minute.

Finally the pip track is used to provide the three pips, and then the whole process is repeated, the only difference, most of the time, being that a new seconds track will have been selected.

In somewhat greater detail the distribution of the tracks is as follows: The first disc (nearest the sonic motor) carries the opening announcement and the hour tracks. The second disc carries only the minute announcements and, in fact, some ingenuity was necessary to accommodate all these on one disc.

Since each announcement is quite short it would be a waste to devote a complete full circle track to it and so the disc is divided in half diametrically. One half of each track carries an even number and the other half an odd number, and separate optical systems, on opposite sides of the drive shaft, scan each half at the same time.

In order that only one announcement will be heard at a time a change-over circuit operates every minute to select alternate optical systems.

The third disc carries the seconds announcements and the pips, plus a 10 Kc track which is used to operate one of the failure alarm systems.

FIXED SYSTEM

For those portions of the announcement which are constant, such as the opening phrase and the pips, the optical systems are fixed and simply play the same track continuously. To select the required tracks for the other portions of the announcement the optical systems are moved across the disc by means of cams which locate the light beam precisely on the required track.

The tracks are concentric and are interlaced so that each alternate one has to be selected to present them in correct order. One group of tracks is scanned as the optical system moves from the outside of the disc toward the centre and the other set as it moves from the centre to the outside. This avoids the rather clumsy movement which would be necessary to bring the optical system quickly from the centre to the outside at the completion of a cycle.

From all these tracks the final selection of the one required at any particular instant is made by a set of five cam-operated contacts. The cams are driven from a gear on the sonic motor shaft and operate the five sets of contacts in succession. Thus the first one switches in the opening phrase "At the third stroke —", the second one the hour announcement, "—it will be ten—", the third the minute phrase, "—fifteen—" and the fourth the seconds, "—and ten seconds". Finally the fifth cam closes the pip switch for the duration of three pips.

The system normally runs attended but elaborate precautions are taken to guard against failure. Two complete clocks are provided and both are fully operative and running the whole time. Only one delivers signals to the distribution centre, but the other is instantly available in the event of failure and the changeover is made automatically.

One clock operates from the mains, the other from the 50 volt exchange battery via a motor generator set. In addition there is a spare motor generator set and an elaborate switchboard to phase the incoming generator with the outgoing one before a changeover is made.

Within the clock itself there are many monitor circuits to supervise its correct working. One of these is a 3.2 Kc tone on each recorded track which is filtered out before the signals are used. The presence of this tone, above a certain level, holds open an alarm circuit which will close in the event of any failure to the signal circuit. Thus a burnt out exciter lamp, a faulty photo cell,

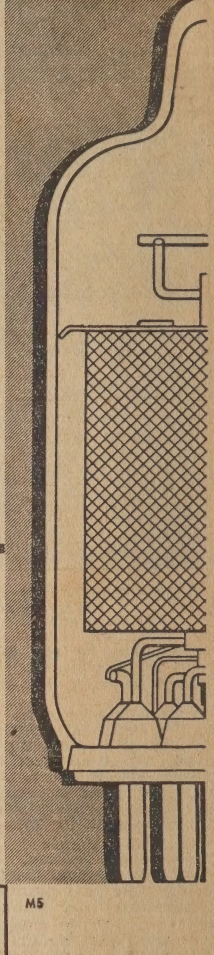
LOW HUM, LOW MICROPHONY, A.F. PENTODE
on the Noval Base

The Mullard A.F. pentode, EF86, has been especially designed for use in resistance-coupled, audio frequency, voltage amplifier circuits. An essential requirement of such circuits, low hum and low microphony from the amplifying valve, is achieved with the EF86 by careful internal screening, rigid electrode structure and by the use of a bifilar heater.

Whilst in normal circuitry the EF86 has the low hum figure of 5 micro-volts referred to the control grid, even this figure can be improved. As the control grid pin of the EF86 is placed equi-distant from its two heater pins, any hum induced from the heater pins may be virtually balanced out by providing the heater winding with an earthed centre-tap. Used in this way, the EF86 has a hum figure of the order of 1.5 micro-volts.

ACTUAL SIZE

EF86



Other important features of this voltage amplifying pentode include high gain, small size and single-ended construction. The EF86 is already widely accepted by Australian engineers —many thousands are in service in tape recorders, amplifying equipment and broadcast stations throughout the Commonwealth.

M5

ABRIDGED DATA

HEATER		CHARACTERISTICS		BASE
Vh	6.3 V	Va	250 V	B9A (Noval)
Ih	0.2 A	Vg2	140 V	
		Ia	3 mA	DIMENSIONS
CAPACITANCES		Ig2	0.6 mA	Max. seated height
Cout	5.5 pF	Vgl	−2 V	49 mm.
Cin	4.0 pF	gm	1.8 mA/V	Max. bulb diameter
Ca-gl	0.025 pF	ra	2.5 MΩ	22 mm.

Mullard

MULLARD-AUSTRALIA PTY. LTD., 35-43 CLARENCE ST., SYDNEY, BX2006. 592 BOURKE ST., MELBOURNE, MU2366.
ASSOCIATED WITH MULLARD LIMITED, LONDON, MULLARD OVERSEAS LIMITED

or any defect in the amplifier stages will all bring up an alarm.

Even the cable which conveys the signals to the City North Telephone Exchange for distribution has a monitor circuit associated with it which will bring up an alarm in the event of failure.

Finally, in the unlikely event of the entire Sydney system failing it would be possible to provide an emergency service by trunk line from Melbourne.

No description of this equipment would be complete without some comment on the fine quality of the construction. Mechanically the whole thing is an example of first-class precision engineering which can only reflect the utmost credit on the designers and builders. It is truly an example of British workmanship at its finest.

Reheat beats sound

Modern high-performance military aircraft need all the power which engine designers can give them, and in order to increase the power developed by a jet engine, the technique known as reheat was devised.

IN a lecture to an expert audience in London, Mr. J. L. Edwards of the de Havilland Engine Company has given an interesting picture of what reheat can do. Mr. Edwards stated that "the modern applications of reheat are to assist the take-off of heavily loaded bombers or to force fighters up to supersonic speeds."

The disadvantage of reheat, which gives increased thrust by burning fuel in the hot gases emerging from a jet engine in a combustion chamber, is the enormous rise in fuel consumption which results. Mr. Edwards took as an example an arbitrary engine giving 17,000lb thrust in which fuel consumption would increase from 2060 gal/hour without reheat to 6360 gal/hour when reheat is used. If the aircraft's speed is raised by M 1.5 at sea level, the reheat consumption would rise to 10,000 gallons per hour. Normal engine fuel-pumps, Mr. Edwards said, would be unable to handle flows of this magnitude, and the turbine-driven centrifugal pump has been developed for the purpose.

The use of reheat has given thrust increases in a de Havilland Vampire of up to 25 pc, and Vampires with reheat in operation have flown at altitudes of up to 50,000ft.

Mr. Edwards said that in recent years designers have begun to talk in terms of Mach 1.5 at sea level and 2.5 or even 3.0 at altitude. To achieve this sort of performance, the bulk of the engine's propulsive thrust must come from the reheat system, and the engine becomes an adjunct to what is in effect a ram-jet (i.e. a cylinder in which the airflow produced by high speed is rammed into a combustion chamber, and the hot gases then emerge as a supersonic jet).

A rental fee of one peppercorn a year is paid by an organisation for use of the old State House at St. George, Bermuda. The island's government receives the token payment at a formal ceremony every spring. So far 138 peppercorns have been paid.

TELEPHONE NET EXTENDS OVER U.S.

A new link has been added near Chicago to the system that will eventually permit you to dial any phone number north of the Rio Grande direct, possibly as early as within 10 years. The seeming American-Canadian miracle of communications is being made possible by the rapid addition of electronic "brains" for the telephone network.

NEWEST in the array of complex "thinking" circuits will permit the addition early next year of 25,000 direct-dial telephones in the Chicago suburbs of Waukegan and Highland Park to those already working in Englewood, N.J., Birmingham, Mich., near Detroit, and suburban Pittsburgh. These places are the "guinea pigs" for direct dialling to millions of phones in 14 major metropolitan areas.

Ultimately, every telephone in the country will have a completely individual number, consisting of a three-figure prefix — for one of the 90 dial areas in Canada and the US and the local number. A typical number here will be 312-De (arborn) 2-1111. Anyone in the country will be able to dial it directly.

USE OF TAPE

Linked with long distance direct dialling is a tape recording device that takes down all the details, except the conversation itself, and transcribes it on a card for billing. The only riddle remaining is how to prevent busy signals from being recorded as completed calls.

Under the lash of rapidly expanding long-distance facilities, the nation's telephones are being welded into a single unit, although there are 5234 independent systems controlling about 8-million of the more than 50-million phones in the nation.

With the US telephones now averaging one for every three persons, the ideal of a complete communication blanket in that country, with a telephone bell within earshot of almost everyone, rapidly is being approached, telephone officials believe. With only 6 pc of the world's population, the US has 60 pc of the 90-million telephones in the world.

Sooner or later the problem of linking direct dialing to other global systems must be conquered, telephone officials confidently believe.

There now are more than twice as many telephones in the world as at the outbreak of World War II. Long distance calls in the US are totalling nearly 200,000,000 a day. Racing with the ever-increasing load between high-density population areas, A.T. & T.'s long lines department has placed in service a new super-coaxial cable system between Chicago and New York that carries 5000 simultaneous conversations.

In the non-test areas where long distance operators dial the numbers, the new electronic brains will enable them to feed metal punch cards into circuit finders and let it go at that, as they have been doing for some time in the new electronic centre at 95 William St. in New York city.

ULTRA MODERN RADIO FROM FRANCE

A sign of the times is this modern-looking receiver recently produced in France. It has a built-in aerial which it is claimed gives good reception without interference on broadcast and short wave bands. It operates from the AC mains without an earth.

MANUFACTURERS OF COMMERCIAL RADIO RECEIVERS FOR 14 YEARS

CLASSIC RADIO

FOR QUALITY

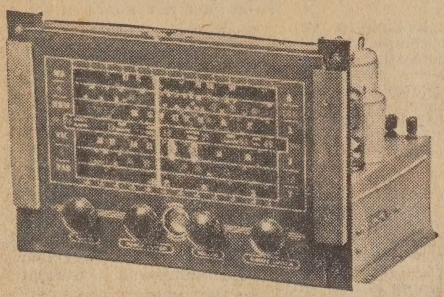
FOR ECONOMY

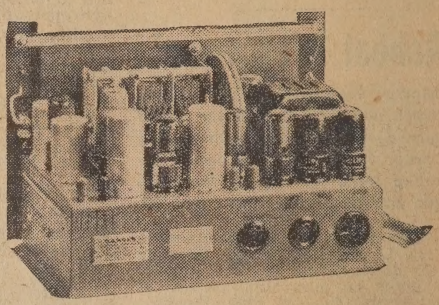
● World Range **£33/15/-** High Fidelity ●

9-Valve De-luxe Dual-Wave Radiogram-Chassis

Including Magic-Eye Tuning Indicator With Matched Dual Speakers

FREIGHT EXTRA





COMPARE THESE FEATURES

- Ultra modern circuit with new high gain valves and permatuned iron cored coils and intermediates giving good interstate reception and a short wave range of 12,000 miles.
- High gain audio with push-pull output and tone control gives you high fidelity reproduction from both radio and your favorite recordings. Inverse feedback incorporated.
- Power switch is fitted to the tone control of all chasses thus enabling the power to be completely switched off from the set. Radiogram switch combined with wave change switch.
- Tuning is made simple and positive even on oversea stations by the use of a super sensitive magic eye tuning indicator.
- All chasses are wired for the fitting of an F.M. or Tape Recorder. Special plug on back of chassis being provided, also standard 3-pin socket for power supply to motor.
- Speakers supplied are Magnavox 12in and 8in permanent magnet with tropic proof transformer.
- Large calibrated edge-lit dial in plate glass (11in x 7in) with main stations in each State in prominent type, fitted with counterweight drive and indicator lights on dial showing which band in operation.
- Dial can be supplied in cream or brown with matching knobs and escutcheon to suit blond or walnut cabinets.

ALL CHASSES CARRY SIX MONTHS' GUARANTEE.

A New 10-Valve Dual-Wave Radiogram Chassis

The ideal chassis for those difficult locations where reception is doubtful

Specifications as nine valve unit but with the addition of high gain tuned R.F. stage giving greater sensitivity and selectivity on both broadcast and short wave bands.

£38/15/-

Large range of Radiogram and Console Cabinets from £12

Record Players and Changers

We have a complete range of 3-speed record playing equipment, including B.S.R. or Garrard Players, with turn-over crystal pick-ups or your choice of Garrard, Stromberg-Carlson, Collaro or the new B.S.R. 3-speed changer that will play 7, 10 or 12in records intermixed. All changers have turn-over Crystal pick-ups.

CLASSIC RADIO

245 Parramatta Rd.,
Haberfield, N.S.W.
Phone UA2145

LABORATORY ON MOUNTAIN TOP

Model aircraft are used extensively for experiments with aeri al arrays and the radio control of aircraft. They are launched from the mountain peak shown in the photograph on page 3.

In California the Stanford Research Institute has a newly acquired research laboratory devoted to the development of aerials for aircraft and particularly for guided missiles. This work calls for special facilities with which the Institute is well provided.

AERIALS carried by aircraft for special purposes such as remote control are invariably directional.

A guided missile for instance is controlled by radio signals reflected from its target and which originate from a transmitter inside its own fuselage. The receiver which picks up these reflections actuates the control mechanism which controls the missile and keeps it pointed to the spot in space from which the strongest signals are received.

If it is to hit the target accurately, the aerials it uses must be very highly directional—not so much as to allow it to swing off the target, but sharp enough to clearly indicate the point of strongest reflection.

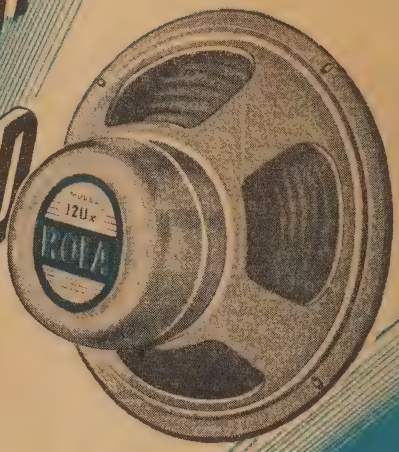
Our pictures show some of the work being done on model planes which can either be flown and guided or supported at the tip of the platform which itself is built at the apex of a high moountain peak.

In the latter case, its response to radio signals sent right across the valley from ground aerials mounted on other mountain peaks can give vital information about the orientation of aerials and the shape of their polar diagrams.

The height of the laboratory is 1700ft. Its facilities also allow ground type micro-wave aerials to be tested over long air paths free from distorting reflections from the surface of the earth in the vicinity.

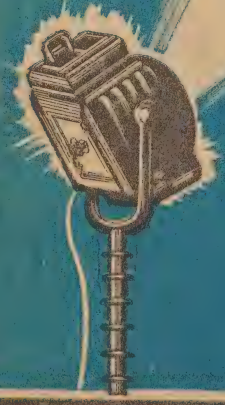
A view of the countryside taken from the launching site gives an idea of the area over which experiments are made.

SPOTLIGHT ON SOUND



Specifications

Power Handling Capacity	12 watts (Peak)
Fundamental Diaphragm Resonance	50 c.p.s. ± 5 c.p.s.
Frequency Response	45-12,000 c.p.s.
Voice Coil Impedance at 400 c.p.s.	8.4 ohms.
Air Gap Flux Density	13,000 Gausses
Total Flux	278,000 Lines



ATKINS (W.A.) LTD.
868 Hay Street, Perth W.A.
HOMECRAFTS PTY. LTD.
350 Lonsdale Street, Melbourne, C.1.

W. & G. GENDERS PTY. LTD.
53 Cameron Street, Launceston, Tas.
HOMECRAFTS PTY. LTD.
100 Clarence Street, Sydney, N.S.W.

A. E. HARROLD
123 Charlotte Street, Brisbane, Q'land.
YEALLS AGENCIES PTY. LTD.
400 Elizabeth Street, Melbourne, C.1.

S. H. HEALING LTD.
151 Pirie Street, Adelaide, S.A.
AND ALL LEADING WHOLESALERS.

CURRENT CLOSE-UP OF SCIENCE

Crystallised Spiders

WE all eat queer things at Christmas, but nobody has yet thought of providing us with, say, crystallised spiders. In our efforts to grow more food for the human race, we are always competing against hordes of hungry insects. One solution to the problem, which has been suggested in all seriousness, is that we should do two jobs at once by eating the insects.

In many parts of the world, where supplies of protein food are less adequate than in Britain, insects are already enjoyed as part of the staple diet. In Siam and other eastern countries, flying insects called cicadae are collected in vast numbers, boiled and eaten. They are said to taste like vegetables. Water-bugs and grubs from bee-hives are also dished up.

Termites are enjoyed as a tasty snack in Africa. The little ant-like insects are scooped out from their colonies and eaten alive. In other parts of the tropics, ants give a characteristic flavor to native dishes.

Although our British spiders are too small to provide us with a decent meal, spiders grow to an appetising size in other countries. In some parts of the East they are caught and eaten alive, providing a badly-needed source of protein. If we did not have so good a diet we should probably be less choosy when it came to eating insects and their pals. Instead of condemning food that was infested with them, we should enjoy it as a source of tasty and nutritious protein.

Atomic Submarines

HARDLY a day gets by without a new wonder metal being gaily introduced to the harassed engineer. One of the latest is zirconium.

This is one of the metals that has been dragged out from obscurity by the needs of atomic energy development. It doesn't absorb neutrons from atomic reactors in the way that other constructional metals do. It also has a tremendous resistance to salt-water corrosion; this combination of properties has made zirconium a "natural" for building the atomic plants that are going into ships and submarines.

Zirconium is also a member of the select band of materials that can be used for patching up the inside of the human body. Zirconium plates are tacked on to battered skulls, and zirconium wire will join up broken bones.

Moths Meet Moths

NATURALISTS have never really cleared up the mystery of how some male insects find their girl friends. Moths, for example, seem to be able to find each other instinctively, without the help of any obvious communication system.

In one experiment, seven male moths were released from a train at intervals of a mile along the track. Every one found its way to a female moth of the same species that had been locked inside a hermetically sealed tube.

Sulphur eating Bugs

ALTHOUGH we tend to think of bacteria almost exclusively in terms of disease that they cause, they are really much more versatile than that. Some of the tough eggs, for example, like to tackle such uninviting things as iron and concrete. Among these are the sulphur-eating bacteria; they can produce sulphuric acid strong enough to break up slabs of concrete into little bits, and scoop holes out of iron pipes buried deeply in the soil.

When the sulphur shortage was at its height, scientists tried to persuade

By J. GORDON COOK, BSc, PhD.

bacteria to release sulphur from sulphur containing minerals. The bacteria worked too slowly to be of much practical help. But since then, special strains of bacteria have been developed that can work six times as fast as the original ones. They may yet be able to help us out with our sulphur problems in industry.

Atomic Problems

ATOMIC energy has given us plenty to think about in the past ten years. One of the queerest problems is a technical one. What do we do with all the radioactive waste that comes from atomic piles?

The materials in this waste are shooting off sub-atomic particles that are dangerous to any living thing. Some of them lose their radioactivity fairly quickly; but others will go on popping off their particles for years. And the atom scientists have to find somewhere to dump these by-products so that they are well out of harm's way. But where?

We cannot simply run the radioactive waste into our sewers or rivers. It's too dangerous. If we bury it carelessly, it might seep into our drinking water. And to store it would mean building increasing numbers of huge tanks that would present a lot of corrosion problems.

One solution is to use the liquid by-products for making concrete slabs. These are then taken out to sea and dumped in the mud at the bottom. There they stay for evermore, getting rid of their radioactivity slowly but surely and doing harm to nobody but the coelacanths.

Another proposal is that we should shoot the radioactive rubbish out into space leaving it to float around with only the odd space-traveller to worry about.

Salts From The Sea

IN these days of raw material shortage, we are turning to the sea as a source of many of the things we need. Magnesium is being extracted from seawater in the USA.

In hot countries, seawater is allowed to evaporate in the sun, leaving its salts behind. The element bromine is extracted from sea-water and used for making anti-knock chemicals that are put into petrol.

In one way or another, the sea has been giving us industrial raw materials since the pre-Christian era. The purple color used as a sign of noble rank by the Roman emperors came from the juices of a shell fish found in the Mediterranean. When scientists wanted to analyse this Tyrian Purple, they had to dissect 12,000 of the shellfish to get less than one and a half grammes of the color. It's not surprising that the Romans found their purple dye expensive.

Today, there is no demand for Imperial Purple. Compared with modern synthetic dyes it is a dull and unattractive color.

PARACHUTE JUMPING FROM 50ft

ONE day, recently, a Gloster Meteor was skimming 50ft over the fields of Oxfordshire at more than 500 mph. For a moment, onlookers thought something was wrong, because suddenly an irregular bundle was hurled upwards from the cockpit. Seconds later the bundle descended gently to earth by parachute.

The bundle was a dummy pilot, simulating an emergency jump. The drop from so low a level was made possible by a Martin-Baker ejection seat. In World War II it was thought unsafe to jump from less than 1000ft using a standard aircrew parachute. Now the company hopes to reduce this minimum to 25ft.

How it is done:

Using this ejection seat, a pilot need only jettison his canopy and then pull down a face-protecting shield. He is fired upwards immediately by a cartridge mechanism, clear of the aircraft's tail. Automatically a small drogue opens, to tilt his seat back and to control the opening of a larger drogue, ensuring that the latter does not split. This large drogue steadies the seat, slowing it down, and allows the pilot to drift clear with his own parachute now fully opened. It is claimed also that within ten seconds of leaving the aircraft, the pilot can be safely on the ground, ready to fight again if the need arises. The whole process is fully automatic from the moment when he says 'good-bye' to his aircraft by operating his face-shield, to the moment of touching terra firma.

You have all seen pictures of lighthouses, but only the lighthouse keeper sees this view from his front window as a supply ship pays its hazardous visit.

THE LIGHT THAT SAVES LIVES

For most of us there is a peculiar fascination about a lighthouse built out on a lonely promontory to guide mariners by night and serve as landmarks by day. The life of a lighthouse-keeper is a lonely one indeed for he is often isolated from land for months at a time, his only contact with land being a radio and a visit from a ship which brings his supplies.

by Calvin Walters

LIGHTHOUSES are placed on projecting headlands, islands, shoals, sandbanks and dangerous parts of the coastland.

Generally speaking, the character of a lighthouse varies as to its purpose. However, the familiar lighthouse placed on projecting headlands usually takes the form of a high tower.

The height of the tower depends on the distance at which it is required that the light be seen, and also upon the type of lighting apparatus which is placed at the top of the tower.

PERILOUS FEAT

For over 2000 years some attempt has been made to give mariners guidance along the perilous coasts of many sea lands.

Even in those far-off days the erection of a lighthouse was at times a perilous feat and at times a masterpiece of engineering, two examples of the latter being the Colossus of Rhodes and the Pharos of Alexandria.

The Colossus of Rhodes was a huge brass statue which bridged the entrance to the harbor and was completed in 280 BC. It was about 100ft high and carried a light in its upraised hand. An earthquake 50 years later threw it to the ground where it lay until 653 AD, when an Arab general sold it for old metal to a Jewish trader.

The Pharos of Alexandria was a lighthouse built upon an island in the Mediterranean Sea before the city of Alexandria. It was built during the time of Ptolemy I in the third century BC and was reputed to be 400ft high. None of it remains today but its place has been taken by a modern lighthouse whose light is visible for 20 miles or more.

The Romans were very active in the erection of beacons and lighthouses in various important ports. A lighthouse built by the Phoenicians at Corruna was rebuilt by the Emperor Trajan and afterwards re-established as a lighthouse in 1634. In 1847 a lens systems was placed in it.

In Boulogne are the remains of a lighthouse which was built by the Emperor Caligula in 40 AD, and at Dover the remains of another Roman lighthouse.

Up to the end of the 18th century most of the lighthouses in England were privately owned and tribute to them was paid by seafarers.

COAL FIRES

Needless to say, the early lighthouses were very inefficient because of the primitive nature of the light and the lack of a suitable optical system.

The first lighthouses were built as towers of stones or bricks surmounted by grates in which burned coal or wood billets.

Some of these used as much as 400 tons of coal a year.

These lights were, as might be expected, very variable depending as they did on the vagaries of the weather. In wet weather it was very difficult to maintain the fire and during the period of a strong off-shore wind the lights would become obscured by clouds of smoke which made the lighthouse of doubtful value as an aid to navigation.

OIL LAMP

Nevertheless, this type of light persisted until 1822 although oil lamps were being experimented with as early as 1760.

However, before oil was used candles were placed in the tower. The famous Eddystone lighthouse, completed in 1759 by James Smeaton, used 24 candles suspended in a chandelier.

It can be imagined that the light from 24 candles unaided by any optical system was very poor. Recourse was made to the use of reflectors first by small glass mirrors arranged to form a paraboloid and

later by silvered reflectors, one to each candle.

In 1780 a wonderful lamp was invented by Argand. This was the wick oil lamp. It was improved upon by a Frenchman who arranged two or more concentric wicks which burned vegetable or animal oils. This was a great improvement, assisted later by the use of mineral oil.

Then came the Welsbach mantle attached to something like a glorified primus stove. This was introduced to lighthouses in 1922 and is still largely used. It raised the available candlepower of the lamp to about 1200, a vast increase from Smeaton's 24.

Naturally enough electricity came in its turn, first by the use of the arc light and then by the incandescent globe.

The lighthouse tower is built usually of masonry of a special type.

The foundations, when built on rocks or shoals in the sea, must be very substantial as they must withstand the action of pounding seas and severe gales.

The surface of the rock is usually chiselled away to make way for the foundations. Blasting is avoided as this may weaken the rock and render it unfit for the lighthouse foundations.

STRUCTURE HEIGHT

The foundation stones are laid and perhaps bolted into the rock. These stones are cut in such a way that they lock or dovetail into each other both horizontally and vertically. Thus the stone structure becomes as one column with a hollow centre into which is built a circular stairway connecting the base with the summit through a series of floors which become storage rooms or the living quarters of the lighthouse keeper.

The height of the structure depends on the area of the rock available for the base. The wider the base the higher the tower can be. It must also be high enough to avoid being submerged by heavy seas.

The structure must also be strong enough to withstand the pounding of heavy seas and the pressure of strong winds which may exert anything up to 1lb per square inch for a 60-mile-an-hour wind and a much greater amount in a hurricane.

Prismatic glass for assembling the framework to form lenses for lighthouses.

It will be seen that the building of a rock lighthouse is fraught with great difficulty and sometimes with danger, although the wonderful organisation attendant to the venture has resulted in no loss of life. Every stone in a rock lighthouse is usually cut and stored on land to await a suitable opportunity for transportation to the site.

It is important that there be no failure of the light at any time, the consequences of which could be tragic. To ensure against this there are often two sources of light, one being electric and the other gas or acetylene. These are arranged in an automatic standby mechanism which swings the failed light out of position and the standby light into position at the correct focus.

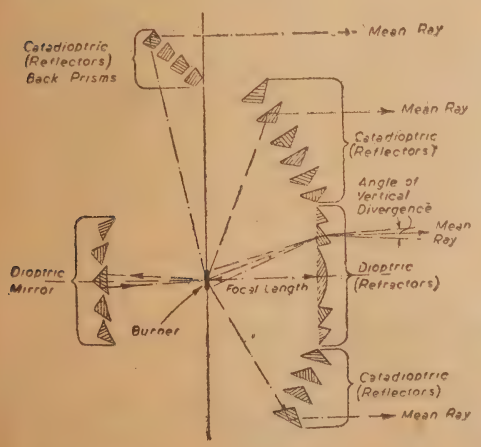


Diagram illustrating the several elements which combine to form a modern lighthouse optical apparatus.

OPTICAL SYSTEM

Sometimes two electric lamps are used. One lamp may be connected to a mains supply and the other to a battery supply, or a special generator in the tower. When a failure of the mains lamp occurs the standby generating set automatically comes into operation and sets off a warning bell in the keepers' quarters. This indicates to him that a failure has occurred and he is able to instal a new lamp when required.

There are various combinations of standby lamp apparatus which may

LOOK

Here's the AUDIOTORIUM Range of High Fidelity Musical Equipment

PICK-UPS

LEAK
Two heads, Diamond Styli and Transformer **£34/18/10**

M.B.H.
12in arm, two heads **£22/14/4**

ACOS
H.G.P. 40, two heads, HiG. **£9/15/-**

GOLDRING
Turn-Over Variable Reluctance **£7/10/-**

MOTORS

THORENS

E53PA	Motor	£30/2/6
CB33S	Player	£38/15/-
CBA83	Auto Player	£46/15/-
CD43	Changer	£61/2/6

AMPLIFIERS

QUAD 11 .. .. **£108/3/-**

LEAK TL10 .. .. **£59/17/6**

SPEAKERS

WHARFEDALE
3 Speaker Network **£66/12/10**

GOODMANS .. .. All types

DUODE **£31/9/-**

BAKER **£26/10/5**

ROLA **£21/0/3**

CABINETS

All Vents as recommended by Speaker Manufacturers can be supplied—including Sand Filled Enclosures.

TAPE RECORDERS

FERROGRAPH 2AN
two speed **£198/-/-**

GRUNDIG TK9
two track **£152/5/-**

TECNICORDA UG4
Ext. Speaker **£139/-/-**

SEE and HEAR THESE AT OUR SHOWROOM

See also the new LEAK Pick-up on Display!

THE AUDIOTORIUM

HIGH FIDELITY SOUND CENTRE

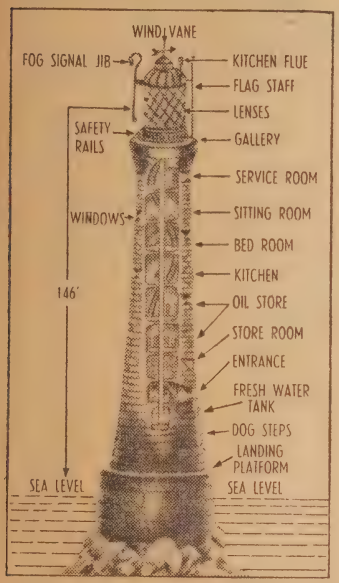
422-4 KENT STREET, SYDNEY. BX6731

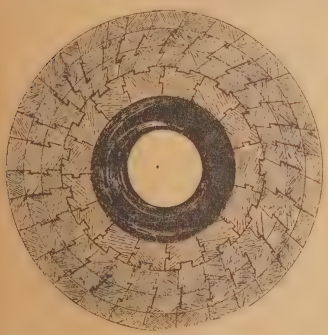
take the form of electric and acetylene, two electric light globes connected to the mains, two globes and gas or acetylene and so on.

All these operate on the automatic principle and it is rare indeed that light is not available for the lighthouses even when unattended, as they frequently are.

No source of light is much good for a lighthouse unless aided by an optical system.

The individual silvered reflectors as mentioned earlier were used up to the early years of the last century when Augustin Fresnel, a French physicist and lighthouse engineer, devised a system using glass prisms.





Top—sectional view of lighthouse. Bottom—Lighthouse stones are dovetailed horizontally and vertically. Each block weighs from 2 to 3 tons.

With this lens all rays of light available to the reflector were collected and focused to a common centre.

It was from this early reflector that the modern lighthouse optical system was evolved although today it assumes enormous proportions and focuses the light to a common beam having, at times, a candlepower of 750,000 and visible at a distance of up to 50 or 60 miles.

Fresnel's first optical system was in the form of a revolving frame fitted with a number of his prisms fixed in panels. This was called a Catoptric lens.

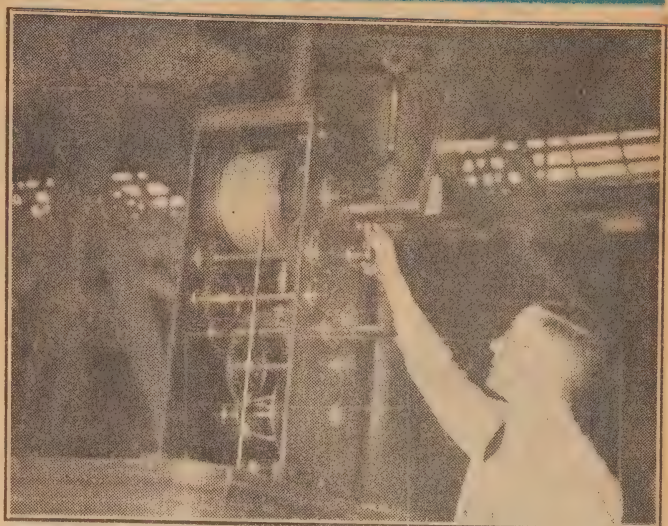
This system collects all the rays falling upon it but it misses a lot of rays which go past the edge of the system. To collect these, metal reflectors were first employed but later replaced with other prisms arranged outside the plane of the first set of prisms.

By taking advantage of the internal reflection of these outer prisms, not much light coming from the light source is lost. This system is widely used today and is called the Catadioptric system. It is really a combination of the parabolic and catoptric systems.

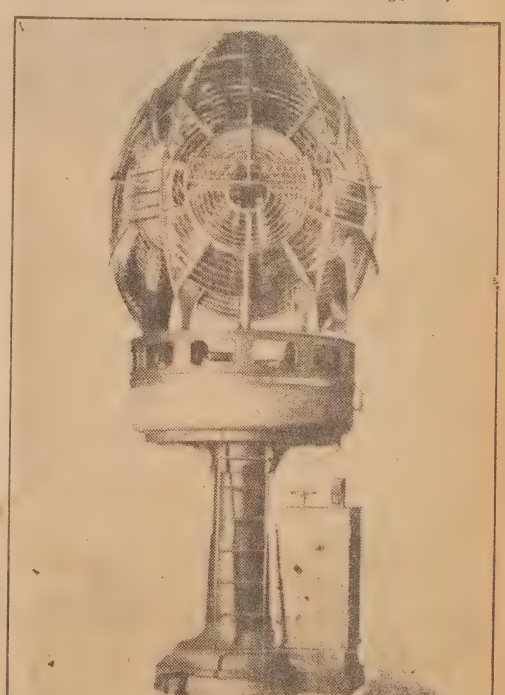
A diagram accompanying this article illustrates the principle of this optical system. It will be seen that at the rear of the light source is placed a dioptic mirror which consists of a series of glass prisms arranged at the focal length of the reflector. Immediately in front of the burner is Fresnel's system of prisms, the centre of which is a

(Continued on Page 103)

ROTATING MECHANISM FOR LENS



The mechanism for rotating the lens which will send the light far out to sea.



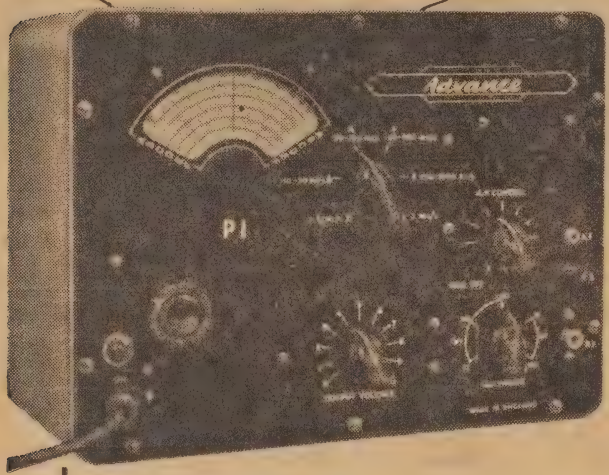
A typical lighthouse optic rotating in a mercury bath by clock-work mechanism. Approximate overall height is 12ft.

THE *Advance* SIGNAL GENERATOR

TYPE P1

SPECIFICALLY DESIGNED FOR THE SERVICE ENGINEER

COVERS 100 kc/s to 100 Mc/s ON FUNDAMENTALS IN SIX RANGES



This latest addition to the famous Advance range puts into the hands of every radio and television service engineer a high-grade instrument with an accuracy out of all proportion to its modest price. This has only been achieved by very careful design — employing accepted standard signal generator technique — and by streamlined production methods.

Up-to-the-minute design of the oscillatory circuit and special attention to screening and filtering ensure that even at 100 Mc/s stray field is less than 3 microvolts.

The P1 employs an accurate attenuator system which embodies a non-inductive slide-wire followed by a five-position 75-ohm ladder network. The 75-ohm cable, correctly terminated by the "Advance" TP8 pad, obviates reflections due to mis-match and ensures that the output voltage at the dummy aerial is substantially that indicated by the attenuators.

Price £32/12/6
Plus Sales Tax

SOLE AUSTRALIAN AGENTS

JACOBY MITCHELL & CO. PTY. LTD.

MA8411 (3 LINES)

Sales and Showrooms, 477 Kent Street, Sydney.

MADE BY ADVANCE COMPONENTS LTD., ENGLAND

Technical Review

NEW DIODE AMPLIFIER USES SEMI-CONDUCTORS

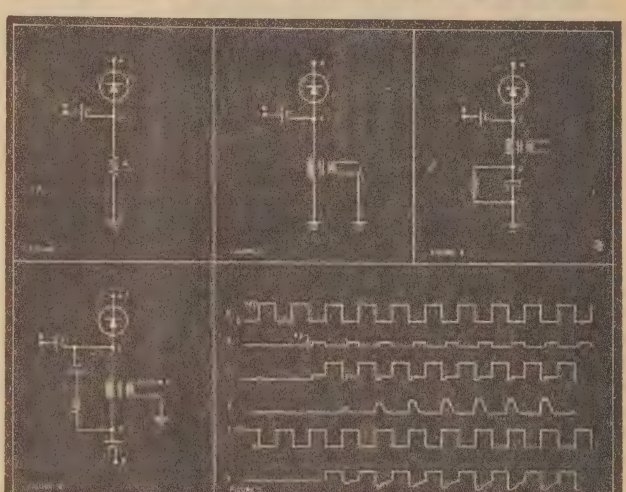
Research on application of semi-conducting diodes has led to the development of a new class of amplifiers that utilizes the reverse transient phenomenon of these two-element rectifying devices.

DEVISED by A. W. Holt of the National Bureau of Standards, the diode amplifier — using no vacuum tubes and achieving power gains up to 10 per stage—promises important application in the future design of high-speed electronic digital computers.

For example, it may be used as a pulse repeater stage, in varied types of flip-flop circuits, or as a wide-band, flat-response amplifier. Because suitable diodes are now in regular production, commercial applications are practical at the present time.

Future improvement in the manufacture of diodes may make the principle useful amplification at even microwave frequencies.

From a material standpoint the device requires a semiconducting crystal which exhibits a large degree of carrier storage. Such carrier storage characteristics have been studied at NBS since 1951, primarily by J. H. Wright. In order to operate the diode as an amplifier it must be supplied with power from an RF source whose frequency is the same or higher than the modulating signal frequency. This requirement puts the circuit in the same category as magnetic and dielectric amplifiers.



Basic diode amplifier circuit developed at NBS. Figure 1, input signal is at B, output is at C, clock power is applied to point A. Figure 2, similar in operation to figure 1, this circuit, the transformer-diode-coupled amplifier, provides current gain by use of a transformer. Figure 3, the addition of a capacitor and resistor between the transformer and ground aids in transformer primary recovery between pulses, on a many-pulse basis. Figure 4, an improvement on the circuit of figure 3 which permits the transformer to recover on a pulse-to-pulse basis is achieved by driving point E with a clock voltage 180 degrees out of phase with the power supply clock. Figure 5, wave-forms at various points in the circuit of figure 4, clock (A) is shown here as a square wave although a half-wave rectified sine wave can also be used. (B) and (F) are respectively input and output signals.

TWO CONDITIONS

A semiconductor diode of the germanium or silicon type has two static conditions: (1) a forward conducting state, characterised by high conductivity, and (2) a reverse conducting state, characterised by low conductivity.

The forward state is achieved by applying a biasing voltage so that the anode is more positive than the cathode; the reverse state is achieved by applying voltage of opposite polarity. The forward voltage acts to create a steady supply of "carriers" of current within the semiconducting material, thus maintaining a condition of high conductivity. Carriers are not created during the reverse static state.

If the voltage applied to the diode is switched quickly from forward to reverse voltage, a transient phenomenon occurs in which a large reverse current flows for an appreciable time after switching takes place, and decays until the static reverse state is reached.

The transient current occurs because the carriers which were present due to the forward voltage remain available to be swept out by the application of the reverse voltage. The carriers do not remain indefinitely during a period of delay between cessation of forward voltage and application of reverse voltage; instead, their number decreases with time during this period.

Although amplification in the diode is not a continuous phenomenon, the action may be likened to the way in which amplification is obtained in a transistor. In a transistor, the emitter can be regarded as a diode existing in the forward conducting state, and the collector as a diode in the reverse state. If any of the carriers created by the forward biased diode are transported to the vicinity of the reverse biased diode, a larger current than the static current will flow in the latter diode.

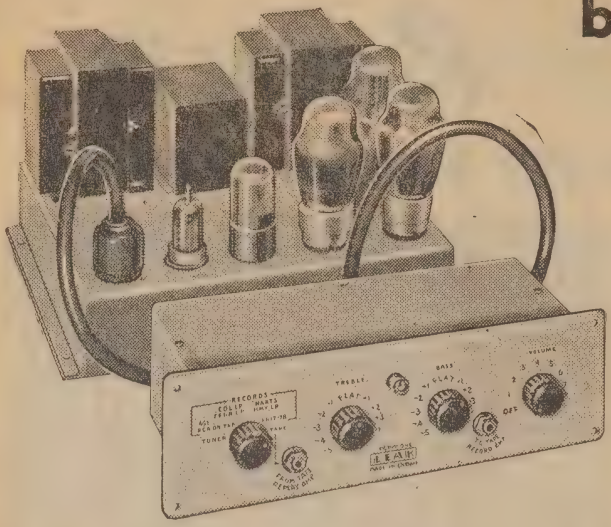
Voltage on the emitter of a transistor produces current which creates carriers. These carriers change the current in the collector, which in turn changes the voltage across the collector.

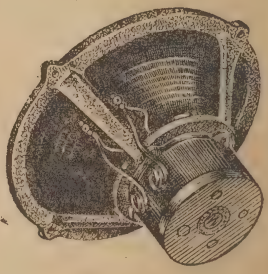
EQUAL CURRENTS

In the case of a junction transistor used in the common base circuit, the collector current is almost equal to the emitter current, so that power gain is effectively determined by the ratio between the forward and the reverse resistances. Thus, power gain is obtained by a transfer of current from one circuit of low impedance to another circuit of high impedance.

The diode amplifier obtains its power gain in a similar manner, ex-

A Combination that cannot be bettered *at any price...*





LEAK

TL/10 Amplifier & Point One Pre-Amplifier

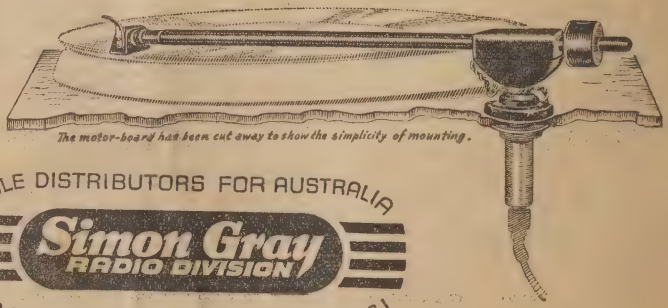
Wharfedale

Super 12" CS/AL Loudspeaker

LEAK

MK. II Pick-up with Interchangeable Heads

For All Further Information, we suggest you contact your Dealer.



The motor-board has been cut away to show the simplicity of mounting.

The Quality of Leak and Wharfedale Equipment is making headlines the world over and is making it one of the Best Sellers.

SOLE DISTRIBUTORS FOR AUSTRALIA

Simon Gray
RADIO DIVISION

28 ELIZABETH STREET MELBOURNE C1

Telephones: MF8166 MF8211

cept that one electrode serves as both emitter and collector, but at different times. During one-half of the cycle, the anode is more positive than the cathode, and the anode acts as the emitter of the junction transistor; during the other half-cycle, the anode acts like a collector.

When it is an emitter, it injects carriers into the germanium with only a small applied forward voltage—i.e., at a low impedance level. When it is a collector, the anode withdraws these same carriers, but only by applying a much higher voltage—at a higher impedance level.

SIMPLEST FORM

The simplest form of diode amplifier is the resistance-diode-coupled circuit (fig. 1). The waveform applied to point A is from a one-megacycle power source. This frequency was chosen for experimental purposes because its one-microsecond period is approximately equal to the decay time of the carriers in the diodes which have been most extensively used.

The RF supply, or "clock," not only acts as the power source but also as the switch which controls the two separate phases of the amplification cycle: the intake of signal power into the amplifier diode (injection of carriers) and the output of amplified power (decay of carriers). As an analogy, the operation of the diode amplifier may be likened to that of a gasoline engine, where fuel is injected during one part of the cycle and fired at a later part of the cycle.

When there is no input at point B, there is no output because of the high impedance of the amplifier diode. A small voltage spike does appear in the output due to the small capacitance of the diode. This, however, can be decreased by paralleling the load resistor with a capacitor for capacitance division.

When point B is raised to plus 2 volts while the clock is at zero volts, carriers are injected into the diode by current in the direction B-C-A. The diode then presents for a short while a very low impedance to the reverse voltage that the clock applies.

POWER GAINS

Since this impedance is low compared to the load resistor, most of the clock voltage appears across the resistor.

Power gains of about 10 (average output divided by average input) have been measured using a 20-volt clock. The only limitation on the amplitude of the clock voltage is that it must not exceed the reverse breakdown voltage.

The requirement on the clock supply is rather severe in that during the time that the clock is at zero volts its impedance should be very low so that as much as possible of the available input signal power will be across the diode and not divided between the diode and the clock source.

In practical applications, the clock voltage may be distributed as a full sine wave and then half-wave rectified near the point of use.

Some circuit element which transforms voltage gain to current gain is essential to most of the circuits using the diode amplifier, because there is no average current gain in the diodes that have been used so far in the experiments performed at the Bureau. The transformer-diode-coupled circuit shown in figure 2 achieves current gain through a step-down transformer. Its operation is similar to the resistance-diode-coupled amplifier.

The circuit in this form is suitable for the amplification of low-duty-cycle pulses but will not operate at high duty cycles because the stored energy in the magnetic circuit will not permit the transformer primary to "recover" or "flyback". A solution to this difficulty is obtained through the addition of a capacitor and resistor between the transformer primary and ground, as shown in figure 3.

This circuit has the disadvantage that the flyback requirements of the inductance are satisfied only on a many-pulse basis and not on a pulse-to-pulse basis. The many-pulse average can also cause trouble in turning off the stage at the end of a train of pulses.

If the end of the transformer primary (point E, fig. 4) were to be driven by a clock voltage 180 degrees out of phase with the power supply clock, the flyback requirements would be satisfied on a pulse-to-pulse basis because the point D would be allowed to fly back or not as necessary.

DURING PULSE

During the time the clock pulse is on and when point A is up, point E is at ground and conventional current flows through the path A-C-D-E. After the power clock pulse, point E is driven positive by the other clock phase, disconnecting the diode between D and E. At this same time, point B may be charging the diode amplifier for the next power clock pulse. The series diode and resistor between C and D provide critical damping of the flyback.

Further development of the diode-amplifier concept leads to the design of a complete "pulse repeater stage" for application in electronic digital computers. The circuit shown in fig. 6 satisfies the essential requirements for a computer stage. It is a combination of the transformer-diode-coupled amplifier (fig 4) and an inhibiting gate Extra logical "or" gates may be added as desired. Delay lines may be used but can be avoided in most cases, since the carriers in the amplifier diode store information. It may be necessary, however, to use some delay lines to time accurately the inhibiting pulses.

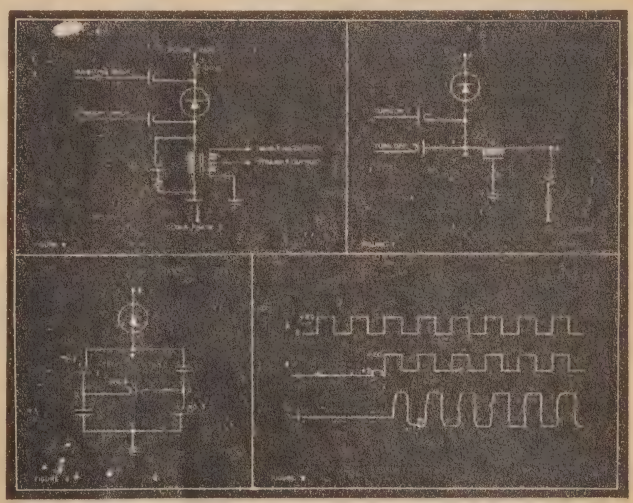
The diode amplifier can be used as the basis for a variety of "dynamic" flip-flop circuits — oscillators which can remain stable either in an oscillating or a nonoscillating state. The circuit shown in fig 7 stores energy between clock pulses in a delay line. The oscillating state is started by raising point B to plus 2 volts to inject carriers.

NEXT PHASE

On the clock pulse immediately following, point B is raised to plus 20 volts, and the pulse travels down the delay line. At point C it sees an open circuit and so is returned in the same polarity at the proper time to inject more carriers into the amplifier diode. The delay line serves as an impedance-matching device as well as a delay line for it can provide the necessary current.

In injecting carriers into the amplifier diode, however, the delay line sees a very low impedance, and so some energy is returned down the line for a third travel, negative this time. At the point C, however, the negative pulse is matched and absorbed; if it were not absorbed, it would travel back down the line a fourth time and prevent the next carrier injection.

Another flip-flop circuit, shown in fig 8, is a current-doubler type. Essentially, it charges two capacitors in series and then discharges them in parallel. If point B is pulled positive, diodes Nos. 1 and 3 are cut off; and current flows through the path B-C-D-E, thus charging the two capacitors in series.



Computer pulse repeater stage, figure 6, which uses the NBS diode amplifier. Additional logical "or" gates may be added as desired. Figure 7, flip-flop circuit stores energy between clock pulses in the delay line (D). Figure 8, current-doubler flip-flop circuit. Condensers are charged in series and discharged in parallel. Figure 9, wave forms of the circuit in figure 8.

A COMPLETE HOME ENTERTAINMENT UNIT

Calstan

Wunderbar

COCKTAIL RADIOGRAM

A well-fitted cocktail bar plus the most advanced World-range Radiogram combination in Australia, with latest American-styled combined radio and record-change unit, for 7 10 and 12 inch records. Full 12in speaker.

Ample record storage in the beautiful maple-veneered cabinet finished in contemporary style.

Two Great New ZENITH RADIO Productions

Calstan

CALibrated to STANdard

RADIOS AND RADIOGRAMS

A SMART NEW AUTOMATIC PORTOGRAM

"AUTO-PORTO"

The portable radiogram that has every wanted feature and sells at a price low enough to surprise you.

- ★ 5-Valve
- ★ Dual wave
- ★ Micro-groove 3-speed record changer
- ★ Attractive leatherette case with carrying handle.

These two Automatic Radiograms, each with strong individual appeal in its own field, have caused immediate enthusiasm.

SEE THEM AT ALL GOOD RADIO DEALERS

Zenith craftsmen designed and built them—sufficient endorsement alone, to technical men in the radio world. Supplies are being maintained and should be available now, in all States.

ZENITH RADIO

Co. Pty. Ltd.
131-133 PALMER ST., SYDNEY.

Distributors at Brisbane, Melbourne and Adelaide.

REPRESENTATION

N.S.W.: Streamline Electric Co., 91A York St., Sydney, BX3886; Breville Wholesalers Pty. Ltd., 161 Parramatta Rd., Annandale, LM5446. VICTORIA: McKinnon Nicholls Pty. Ltd., 468 Collins St., Melbourne, MB1501. QUEENSLAND: Irvines Ltd., Albert St., Brisbane, B2421; N. C. Tritton, 240 Queen St., Brisbane, B7791. SOUTH AUSTRALIA: Clarkson Ltd., 135 Arundel St., Adelaide, W2911; L. W. & L. F. Tyquin, 234 Morphett St., Adelaide, LA4075.

OPTIMUM BAND FOR CHECKING WEATHER BY RADAR

The early use of centimetre radar showed that apart from detecting targets as solid objects, it could be used to indicate the presence of clouds and rainstorms. Radar operators of more advanced equipment became expert at interpreting PPI patterns so that the nature of the weather ahead of aircraft could be more accurately estimated than by visual means.

THE resolution of radar patterns is that quality which allows detail to be seen in what would otherwise be evenly "painted" outlines. It is often essential to know more about the object detected than its mere presence.

This applies particularly to rainstorms through which an aircraft may either fly with safety, or decide to avoid as being difficult or even dangerous to penetrate.

Valuable progress on these lines appears to have been made with a new Bendix receiver, some details of which are given below, in addition to two photographs illustrating the improvement over more conventional radar equipment.

Resolution of radar, which depends upon wavelength, increases directly with frequency or inversely with wavelength.

Operational tests using X-band wavelengths (3 cm) show that while it gives excellent pictures of the front of storms, it is incapable of penetrating moderate to heavy rainfall. At least, it cannot give the pilot sufficient information as to what lies behind the front portion.

Theoretical studies indicate that for weather mapping a wavelength between 3 and 10 cm (the latter has less inherent resolution but greater penetrating power) may prove optimum.

Special equipment operating in the C band (5.5 cm) has been flown a total of 133 hours, 80 of which were in the immediate vicinity of, or through corridors of thunderstorms.

From the results, it has been concluded that such equipment will permit a pilot to avoid moderate and heavier turbulence associated with thunderstorm and precipitation areas, usually by detours in the order of five miles or less from the planned flight path.

Pilots were able to penetrate visually 15 miles or more of heavy rain that was falling at a rate of not less than 60 mm an hour.

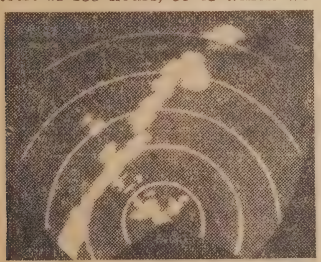
There was no evidence, however, that the radar equipment was capable of identifying a tornado or tornado thunderstorm, although satisfactory warning was provided of hail shafts.

Isoecho contour circuitry appears essential for determining which corridors in a storm area may be flown through with safety.

Isoecho circuits show which part of a storm is most turbulent (where the change from no rain to heavy rain is likely to occur in the shortest distance). The indication is a dark spot or patch within a bright display on the cathode-ray tube.

In the equipment used, transmitter frequency was 5435 mc; peak power 80 kw; duty cycle, 0.0008; pulse repetition frequency, 400 cycles; pulse width, 2 micro-seconds. The receiver had a sensitivity of 101.2 dbm; 3-db band-width, 0.9 mc; noise figure, 14.5 db; i-f, 60.2 mc; i-f voltage gain, 85 db and preamplifier voltage gain of 27db.

Information on employment of this hitherto unused radar band comes from the United Air Lines, Inc. publication, Evaluation of C Band (5.5 cm) Airborne Weather Radar prepared by Henry T. Harrison and E. A. Post Electronics.



Limited range of light intensities in cathode-ray tube screen makes storm display appear uniform throughout with ordinary circuits.

Intense portions of storm where rainfall is heaviest are seen as black holes using new isoecho circuits in Bendix RDR-1 radar.

ARTIFICIAL TAPE REVERBERATION

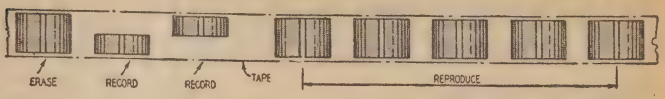


Fig. 1—Diagram showing arrangement of erase, record and reproduce heads. Record heads cover one track (channel) only; reproduce heads cover whole tape.

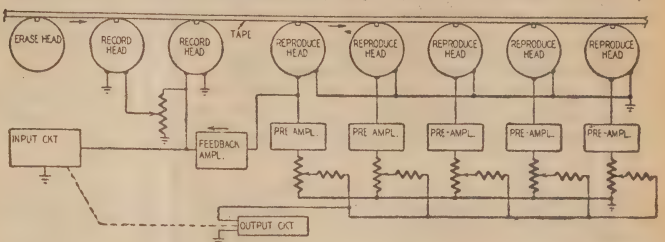


Fig. 2—Sound from input circuit is recorded at two different points. Separate preamplifier volume controls permit a gradual decay of sound.

Echoes and reverberations are among the special sound effects needed in dramatic shows and for commercial announcements. This invention, simpler than most previous ones of this type, reproduces multiple sounds from tape.

THE tape passes over an erase head (Fig. 1) as in conventional machines. Two record heads are next in line. Each of these covers only a single channel, that is, half the tape width. The five reproduce heads cover the entire tape width so they are affected by both channels.

The desired sound from an input circuit is recorded by each record head at different points along the tape (Fig. 2). Thus as each reproduce head passes these points, the sounds become audible. The original sound is heard 10 different times since there are five reproduce heads and two record heads.

Each reproduce head has its own preamplifier and attenuator. This makes it possible to adjust the volume controls so that each reverberation is weaker than the previous one. Furthermore, note that one record head is fed with the full input while the other receives a fraction of this voltage. Therefore the first five reverberations heard (from the upper channel) will sound louder than the next series, which are recorded on the lower channel.

Another feature is that the output of one or more reproduce heads may be fed back through an amplifier for re-recording. Thus, if desired, an echo can be sustained indefinitely.

—Radio Electronics

"Q-PLUS" PRE-FAB TUNING UNITS

WHAT IS "PRE-FAB"?

As its name implies it is a prefabricated tuning unit. It is the whole front end of the receiver already wired, set tested, aligned and sealed.

WHAT DOES PRE-FAB MEAN TO YOU?

It mans that anyone with only the simplest tools can build a set with equal or better than commercial set performance—expensive alignment equipment being not necessary.

You may seem to pay little more initially, but remember, the price includes gang condenser, valve sockets, bypass condensers, resistors, AVC filter components, terminal strips, hardware grommets, etc.

WHAT SIZE CHASSIS DO I NEED?

All pre-fab units with an RF Stage use the one size chassis—the main chassis requires a hole 6in x 5in—5in being back from the dial. 4 holes 5/23in diam. with centres 4½in x 6¾in will then nicely accommodate the unit.

WHAT CIRCUIT SHOULD I USE?

Radio and Hobbies Dec. 1954 issue, gives a reliable circuit and this is entirley recommended.

TYPE DWRP-5
Q-PLUS PRE-FAB TUNING UNIT

A Dual Wave Tuning Unit with Gramo Position.

SWITCH POSITIONS

— Max anti-clockwise —Pick up.
(Consisting of 3 sets of spare contacts)
Middle — 535 Kcs — 1630 Kcs .. .. .. B/C.
Max. Clockwise — 5.9 M/cs — 18.00 M/cs .. .. SW.

MOUNTING

— Refer to page 1 of TWRS sheet.

VALVE TYPES

— 1 6BA6 and 1 6AE8 required.

DIAL

— Any 16-50 M Dual Wave Dial to Match AWA Gang.

WIRING CODE

—Same as TWRS Unit.

SENSITIVITY

— Broadcast Band — Less than 1 uV
SW 5.9 M/cs .. .. 3 uV
16.00 M/cs .. .. 2 uV
18.00 M/cs .. .. 1 uV
These were taken with one IF Stage.

IF TYPES

— IF8 + IF9 in standard size
or
IF1 + IF2 in miniature range

MANUFACTURED BY

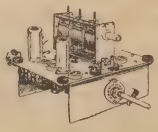
R. W. STEANE & Co. Pty. Ltd., Auburn, Vic.

TYPE TWR5

"Q"-PLUS PRE-FAB TUNING UNIT

A TRIPLE WAVE AND GRAMO TUNING UNIT, PRE-WIRED AND PRE-ALIGNED.

SWITCH POSITIONS



1. (Max. anti-clockwise) = pick-up consisting of 3 sets contacts on reverse side of each switch wafer.
2. 535 Kcs.—1630 Kcs = B/C.
3. 2.8 Mcs.—8.0 Mcs. = Medium band.
4. 7.5—23.00 Mcs Short Wave Band.

CHASSIS MOUNTING

.—The unit is designed to fit on the right-hand side of a chassis with the IF transformers and valves running along the back to the audio and power sections which are adjacent to the unit.

A cut-out 6in x 5in is necessary (5in deep commencing right at the front of the chassis) and 6in long. 4 holes with centres 4½in and 6¾in apart respectively will accommodate the prefab. unit, which comes with rubber mounting grommets.

VALVE TYPES

.—The TWR5/1 unit requires the addition of 1 type 6BA6 valve and 1 type 6AE8.

DIAL

—The EFCO dial type no. USL46 is designed for use with this unit.

WIRING CODE

—FROM BACK HOLE NEAREST CORNER.
Blue = IF plate.
Red = B+250 volts.
Green = AVC supply.

FROM BACK HOLE NEAR MIDDLE.
Green = Filament supply 6.3 volts. other lead through earth.
Red = Screen supply. See later note.

TYPE TWR5

"Q-PLUS" PRE-FAB TUNING UNIT

RED LEAD FROM FRONT NEAR SWITCH = AERIAL.

SENSITIVITY

With one stage IF amplification sensitivities of less than 1 micro-volt were obtained on the B/C band, whilst the sensitivities on the other band were as follows:—

MEDIUM BAND

3.00 M/cs. 2 uV.
5.00 M/cs. 1.5 uV
8.00 M/cs. 1.2 uV

SHORT-WAVE BAND

8.2 M/cs. 4 uV.
14.0 M/cs. 3 uV
21.0 M/cs. 2 uV

ALIGNMENT

.—As previously remarked the alignment of this unit is complete and no further adjustment should be necessary.

IF TYPES

—In the standard size "Q PLUS" IF 8 and 9 or in the miniature size "Q PLUS" 1 and 2 are the most suitable types.

SCREEN SUPPLY

—Recommended supply is from 250 volt B+ source through 30,000 W. 2-watt resistor. + bled by 30,000 W. 1-watt resistor. See circuit.

N.B.—A separate screen supply source is needed for IF channel.

R. W. STEANE & Co. Pty. Ltd., Auburn, Vic.

NEWS AND VIEWS OF THE MONTH

Flying saucers

PEOPLE no longer smile when flying saucers are discussed, nor do they seek for outlandish explanations for them.

They are pretty well convinced by the authenticity of some reports that there are such things.

After all, only one such report needs to be true to establish that some super type of flying machine is really in the air.

Mr. Georg Klein, of Zurich, Switzerland, has no illusions.

He was an expert in the German War Ministry of Production concerned with secret weapons.

He said, "'Flying saucers' are a continuation of German wartime experiments.

"Their prototypes were built in Germany in World War II.

"I saw one which reached a height of 40,000 feet in three minutes near Prague in 1945."

Klein said the Russians captured German technicians and the scale model of a "saucer" at Breslau.

The Russians had not returned the technicians to Germany.

Klein described Walther Miethe as the key man in the German experiments.

Miethe, who had fled to the West, now worked in the United States.

Klein said two types of "flying saucers" built today were:

A model with 12 jets and a diameter of 126 feet;

A model with five jets and a diameter of 48 feet.

Klein said "flying saucers" developed in Canada had reached speeds up to 1500 miles an hour.

Soon after the end of World War II, an Austrian journalist visited us here in Sydney, and told us of a weird flying machine he had seen in Germany which sounded very much like the small "saucer" mentioned above.

He called it a "flying beetle," and described its behavior in the same terms as the saucers of today.

At the time we didn't know what to think of his strange story. The world was full of many such. But it's possible he was right after all.

At any rate, his explanation is much easier to take than the one about super-bees from another planet.

★ ★ ★

Underwater battle

BRITAIN'S defence chiefs are planning a fleet of submarines able to seek out and fight enemy submarines under water.

These new submarines will be able to hit back at hostile aircraft with "an amazing new weapon."

The weapon, which can be released while a submarine is submerged, shoots from the sea into the air at the speed of a shell.

The submarines will be able to give convoys coast-to-coast protection without surfacing because of extra speed, less vulnerability to attack and ability to stay for a long period under water.

The correspondent says Admiralty talks on the use of submarines for convoy escort are sufficiently advanced for a hunter-killer submarine program to be included in the next Naval estimates.

Two experimental, streamlined submarines, using high-test peroxide for propulsion, are nearing completion.

Their underwater speed is believed to be well above 20 knots.

One is the Explorer, launched last March.

★ ★ ★

Following the sun

A US syndicate plans to erect a six-story office building on a turntable.

The building will turn so that it always faces the sun.

A group of Texas oil executives plans to have the building completed in Grand Junction, Colorado, by 1960.

Clockwork in the base of a giant pivot will turn the futuristic building as the sun moves across the sky.

The building, which will cost about £A1-million, will be made of translucent bricks and a light, durable metal.

Oil from the air

ELABORATE equipment in a Percival Prince aircraft that can tabulate rock structures from as high as 3000ft has arrived in Sydney.

As the plane flies over terrain, delicate electronic machines register mineral deposits on a graph.

Nerve centre is a magnetometer

POPULAR SCIENCE QUIZ

Q. What is meant by "toxicity index"?

A. This is a term used in a method, developed by Dr. Salle, of the University of California, of evaluating germicides — a method that simulates actual treatment of wounds.

Pieces of living heart from chick embryos are placed in several test tubes with bacteria commonly found in wounds. After the bacteria have invaded the tissue, just as they do in infections, various dilutions of the germicide are added. The germicide is then washed off and the tissue placed in flasks for observation.

No bacterial growth means that all of the bacteria have been killed. If the tissue does not grow, it indicates that the germicide is toxic to tissue. By comparing the highest dilution that still is toxic with the highest dilution that kills all the bacteria, Dr. Salle arrives at a numerical value. He calls it the "toxicity index".

An index less than one means the germicide is more toxic to bacteria than to tissue. The smaller the index, the more nearly perfect the germicide. Iodine with toxicity index of .1 is one of the most effective germicides evaluated by the new method.

Q. How does ceramic fireproofing prolong the life of jet engine metals?

A. Scientists at an aeronautical development laboratory in California have developed a ceramic fireproofing paint which can be sprayed on to jet engines to increase the resistance to the blistering heat generated by the jet flames. "Brushed" on with the scorching blaze of a special spray gun, the paint quickly solidifies on the metal.

The new paint is a cermet, so termed because it is a ceramic-metal mixture. Experiments are in hand with a nickel-magnesia powder, although other combinations have been developed.

The special spray gun is a modified version of the type used in metal spray-welding. Its intense oxygen-acetylene blaze melts the cermet powder and blasts it on to the jet engine metal. The powder is fed to the nozzle of the gun under nitrogen pressure.

Temperature of 5500 degrees Fahrenheit are generated in the nozzle flame. Although the engine metal ordinarily could not withstand a furnace technique involving temperatures this high, the quick flame-spraying method creates no metallurgical problem.

The sprayed coating can be controlled down to one-thousandth of an inch. It can withstand temperatures up to 3500 degrees Fahrenheit for limited periods, thus giving protection from the jet's hot flame to the more vulnerable metal underneath.

Q. What is the effect of adding antibiotics to tooth fillings?

A. Reported studies by a dentist and a chemical engineer in New York suggest that adding a mixture of antibiotics to the fillings for teeth cavities can help check further decay. The antibiotics so tested were aureomycin, bacitracin, chloramphenicol, and streptomycin.

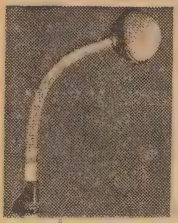
They report also that zinc cements, silicate cements and silver amalgam have some bacteria-killing effect and, therefore, play a part in preventing of further decay. Adding the antibiotic increases this effect and also imparts the effect to direct filling resins which otherwise lack it.

SWITCH TO AWA

PUBLIC ADDRESS MICROPHONES

A.W.A. Ronette Crystal Microphones and Accessories

AWA RONETTE



D88/F. Filtercell, omnidirectional, with flexible chromium plated suspension.

GS210 and GS210/L. Streamlined, chrome finish, filtercell, high or low impedance.

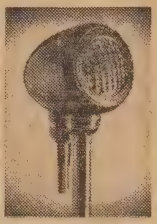
FF2-OV, FF2-P. "Ronofluid" turnover crystal pickup with alternate response characteristics.

44. Hand or desk mounting, counter balanced base, ivory plastic housing

K407. Contact microphone for attachment to musical instruments — also used as throat microphone.

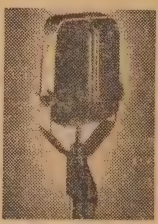
HM7. Hand or stand microphone, filtercell, robust diecast housing attractively finished.

S742. Duo cell, omnidirectional, suitable for cable suspension.



B110. Plastic torpedo form.

R474. Studio type, 4 cell, omnidirectional.



R572 and R572/L. Studio type, duo cell, omnidirectional, high or low impedance.

RFC and RFC5/L. Single cell semi-directional, high or low impedance.

C53. Hand or stand, omnidirectional, black plastic housing and hand grip.

AWA Reslo

An extensive range of A.W.A. Ronette and Reslo microphones is available for all requirements.

RVA and RVH. High quality ribbon velocity available in high or low impedance.

URA/S and URH/S. Ribbon velocity with sliding type muting switch. High or low impedance.

PGD and PGD/H. Dynamic with metal diaphragm. High or low impedance.

AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED

47 YORK STREET, SYDNEY, BO233. 167 QUEEN STREET, MELBOURNE, MU9161.

Available in other States from

NEWTON McLAREN LTD., ADELAIDE. NOYES BROS. (MELBOURNE) LTD., HOBART AND LAUNCESTON.
CHANDLERS PTY. LTD., BRISBANE. NICHOLSONS LTD., PERTH.
ALSO FROM LEADING WHOLESALERS

head, set in the tail of the aircraft like an insect sting.

The plane and equipment, worth £75,000, will be used to detect oil, mineral and uranium deposits.

A scintillometer measures radio-activity, and a magnetometer registers the strength of the earth's magnetic field.

★ ★ ★

Cause of smog

SMOG, the combination of smoke and fog that plagues many industrialised cities, may be largely caused by sunlight.

Researchers from Stamford University found that smog is heavy in the Los Angeles area because that area has so much sunshine.

When the sky above is cloudless and the air stagnant, impurities from motor vehicles and factories do not blow away and are activated by sunlight.

The result is a haze that irritates the eyes, throat and lungs, and causes damage to crops.

The largest single source of air pollution in Los Angeles, the study showed, is exhaust fumes from motor vehicles.

★ ★ ★

Guided missiles

PATRONS of the newsreels recently saw unmistakable evidence of things to come in aerial warfare.

And aerial warfare might well be the only type that really matters in the future. By the time men can come to hand-to-hand grips wars could well be lost and won.

The newsreel showed a guided missile being launched from the ground toward a presumably enemy aircraft, and another being launched at a similar target from an attacking plane.

In both cases the rocket propelled missile sought out its prey with unerring aim and blew it to smithereens.

The remorselessness of the aerial pursuit was indicated by the snaking path of the rocket.

In its flight through the air, the smoke trail could be seen weaving about as slight changes in direction took place. Normally these would have been sufficient to send it off the target to a probable miss. But all the time the warhead kept pointed toward the doomed, radio controlled "enemy," and the control apparatus within corrected for all such changes.

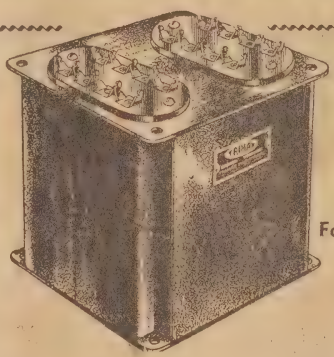
It was only a matter of time before the enemy, rocket, and all disappeared in a shattered mess of high explosive.

The guiding of the missile is carried out by a tiny radar set in the nose, which is connected to the controls. The radar keeps the missile headed in the direction of its strongest received signal, which will be that reflected from the fuselage of the target plane.

A direct hit is not necessary to explode the charge. Proximity fuses will set it off when the little receiver brings in signals of a certain high value, so that the missile can still destroy by means of a near miss.

The high speed of modern aircraft, and the possibility of using guided missiles to attack makes the process of interception too fast for human reactions. The next war will be fought initially by machines against machines probably high above the earth.

TRIMAX
TRANSFORMERS
give the best performance!



For the "Williamson" Amplifier

TYPE	IMPED. RATIO IN OHMS	
	PRI.	SEC.
TA 996A	10,000	16/4
TA 1023	10,000	12/3
TA 1006A	10,000	8/2

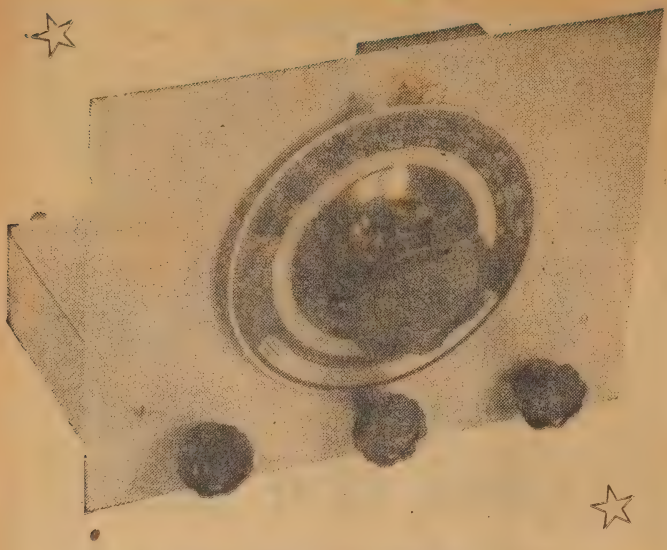
For "Ultra-Linear" amplifier with almost complete elimination of odd harmonics.

TYPE	IMPED. RATIO IN OHMS	
	PRI.	SEC.
TA 1209	6,600	16/4
TA 1208	6,600	12/3
TA 1207	6,600	8/2

★ DON'T FORGET—The New TRIMAX Catalogue is ready Write for your copy!

CHANDLERS

Head Office and Wholesale Dept.,
Cnr. ALBERT & CHARLOTTE STS., Brisbane. FA0341.
Branches at CAIRNS, TOWNSVILLE, MACKAY, ROCKHAMPTON, BUNDABERG, MARYBOROUGH, WARWICK, TOOWOOMBA.



A simple type of vernier tuning dial is needed for accurate logging of stations. Controls left to right are reaction, tuning and volume control.

graph, we have not attempted to make a "Dick Tracy Wrist-watch radio". But by using the latest miniature valves and small components, we have produced a set of small dimensions, which can really go places. By packing the components more closely, the size could no doubt be reduced even further. In the interest of clarity, however, we have kept the layout quite open.

The circuit of the set consists of a 6AU6 high-gain miniature pentode used as a regenerative detector, and a pentode output valve. As we have laid the emphasis on simplicity, plug-in coils are provided. This is accomplished quite easily because there is only one tuned circuit to worry about.

The use of a high-gain valve in the detector stage presents a bit of a problem. The gain is quite sufficient, but the stage oscillates very easily, making the setting of the reaction control very critical. We have therefore deliberately bypassed the reaction winding with a 100 mmF condenser to earth. Quite a lot will, of course, depend on the actual layout of your set, and you might find that you have to alter the value of this capacitor to obtain best results.

TUNING GANG

We have used a standard type 400 mmF single-gang tuning condenser. This, with the coil data given later

A MINIATURE D-X SET

In our November issue Mr. Williams described a small two-valve set in which he made use of the 6SH7, which is at present freely available on the disposals market at a very reasonable price. Small and simple as this set was, it gave excellent results. The design appealed to many of our readers, both budding hams and family men, who like to listen in to short wave.

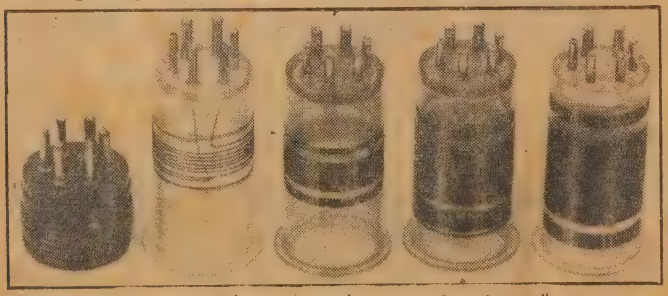
by L. Varady

THIS set demonstrated that it is possible to build a receiver quite economically, without having to sacrifice good performance.

Mr. Williams mentioned the fact that the set could have been designed equally well using the latest miniature components, making some kind of a "miniature marvel". Since the publication of the Junior DX'er we have received quite a number of letters asking: "Why not do it?"

Here, then, was the basis of our "Miniature DX'er".

As you can see from the photo-



This picture shows a complete set of tuning coils

in this article, will cover the entire broadcast band in one sweep, and there is something to spare on both ends. This is due to the fact that there are no parallel capacitors in the circuit and the minimum capacitance is very small. The use of trimmers, as in a superhet, considerably reduces the coverage on the high-frequency end, but at the same time spaces the available stations further apart on the dial.

The detected signal is passed through a .02 mF coupling condenser and a .5 meg. volume control to the grid of a high-gain output valve, a 6BV7. A 6M5 valve could have been used equally well, and if you happen to have one on hand, it may be used without any alteration of the circuit. There is enough power available to drive a loud speaker even on the not-so-strong stations. We have therefore incorporated a small output transformer in the circuit.

The secondary of this transformer is connected to a jack at the back of the chassis. You can plug the speaker into it, or, if you prefer to use headphones, they will work from it also. High impedance headphones are hard to come by anyway, whereas low

impedance phones are available in any quantity and at a reasonable price.

The 6BV7 is actually a duo-diode-pentode. We do not require the diodes, so we simply connected the diode plates to the cathode.

The power supply is somewhat more elaborate than that of the previous circuit. A 30 mA 150/150 V Transformer with a 6.3 V 2A filament winding supplies all the power we need in this case. We have used a 6X5 rectifier, although there is no reason why some other indirectly-heated type, such as the 6X5, 6V4, or EZ82 could not be used.

Small transformers of this type are usually supplied without an electrostatic shield between primary and secondary windings. To prevent signal pickup from the mains it was found necessary to connect a .001 mfd mica condenser from each side of the HT secondary to earth.

By substituting a 6BV7 for the original 6SH7 we have naturally increased the current drain on the rectifier. To obtain adequate HT we had to modify the filter. It now consists of 2 8 mfd electrolytics and a small filter choke. At a drain of approximately 25 mA, this arrangement provides just under 150 volts, adequate for the 6BV7.

CHASSIS & LAYOUT

We have built the complete receiver on a chassis 8 x 5 x 2in. An aluminium panel 7 x 9in carries the vernier dial, the reaction control and the volume control. The tuning condenser, reaction control, coil and detector are neatly grouped on the left-hand side of the chassis and mounted as close together as possible to keep interconnecting leads short. The output valve fits neatly behind the tuning gang. The power transformer and rectifier valve occupy the right-hand side.

The chassis itself was bent up from a piece of sheet aluminium 9 x 8in, and the two ends fitted separately, using small aluminium corner pieces to hold them in place.

After drilling the necessary holes we mounted the individual components into place. The layout is clearly visible in the photograph. To bring the centre of the dial as near to the centre of the panel as possible, we mounted the tuning condenser "on its back" on two small aluminium brackets

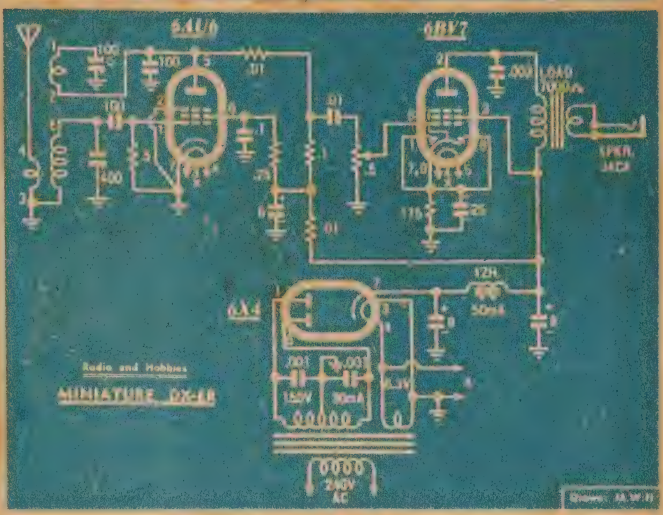
CONDENSER SHAFT

Most of these condensers have a very short 3-8in shaft. Depending on the type of dial, you will have to fit a 3-8 to 3-8 or 3-8 to ¼in extension shaft to it. It is also important to give plenty of clearance to this shaft through the front panel or to fit it with an insulating bush so as to prevent electrical contact between the two. Scraping noises in the loudspeaker will be the result if you do not observe this point.

The reaction condenser—100 pf single-hole mounting type—is mounted underneath the chassis in the front left-hand corner. The coil and the detector sockets are mounted directly behind this condenser.

We found a six-pin socket most convenient to use for the coils, with the two thick pins directly above the reaction condenser.

CIRCUIT OF MINIATURE DX-ER



The circuit provides for a pentode detector valve and an audio stage with enough power to work a loudspeaker. The output transformer should be mounted on the chassis for convenient connections of either loudspeaker or headphones.

The output transformer and the filter choke occupy the centre portion of the chassis. It would be an idea to mount these two components first of all, because their fixing screws are directly beneath the tuning gang. The detector and output valve sockets are separated by a four-terminal tag strip, which provides support for practically all the components associated with these two valves.

The .02 mfd coupling condenser is mounted above this tag strip.

The filter choke and the two electrolytics are grouped around the rectifier socket. All the leads from the power transformer have been brought through two rubber grommeted holes to the respective terminals. A small three-terminal tag strip was used as a distribution point of the filament wiring, and another one serves as an anchor point for the mains cable. To prevent undue strain on the soldered connections, a knot should be put in the mains cable, just after it passes through the grommet into the chassis.

The volume control has been placed in the front right-hand corner. As shown in the photograph, the leads

PARTS LIST

(Components are listed as used in the original layout.).

1 Chassis 8 x 5 x 2.
1 Panel 9 x 7in. (To suit dial.)
1 Vernier dial.
1 100 pf reaction capacitor.
2 Knobs.
1 Tuning capacitor single gang 400 pf.
1 Extension shaft 3/8 to 3/8 in to suit gang and dial.
1 Power transformer, 150/150 v, 30 mA, 6.3 V 2A.
2 7-pin miniature sockets.
1 9-pin miniature socket
1 6AU6 Valve.
1 6BV7 Valve.
1 6X4 Valve.
1 6-pin valve socket (Or to suit coil formers.)
5 1½in coil formers (Plug in type.)
1 Miniature Reinartz coil (if required.)
1 12H 40 mA filter choke.
1 Output transformer (7000 ohm primary, secondary to suit speaker.)
2 Spring terminals. (Red and black.)
1 Phone jack.

CAPACITORS

3 8mfd Electrolytics, 350 V., 1 25 mfd 40 V Electrolytic, 1 .1 mfd paper tubular.
1 .02 mfd tubular, 1 .002 mica, 2 .001 mica, 1 250 pf mica, 2 100 pf mica.

RESISTORS

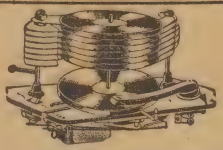
1 .5 meg, 1 .1 meg, 2 10,000 ohm, 1 .25 meg. (All half watt.)
1 175 ohm, 1 watt
1 .5 meg potentiometer.

SUNDRIES

Winding wire for coils, 3 grommets, power flex and plug, solder lugs, bolts and nuts, hook-up wire, solder, 1 4-pos. 2 3-pos. 1 2 pos. tag strips.

Homecrafts PTY. LTD.

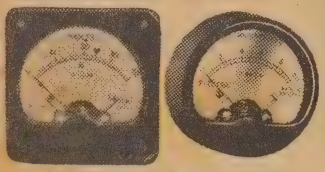
LARGEST STOCKS, GREATEST BARGAINS



BARGAIN RECORD CHANGER

IMPORTED SWISS "PAILLARD"

A masterpiece in Record Changers, featuring variable speed, Crystal Pick-up, etc. Brand new.
Cut to only £6 plus 16 2-3% Tax.



METER BARGAINS

FINE QUALITY METERS—English Moving Coil, 2in Scale—200 ohms per Volt:—

0-20 Volt	14/11
0-40 Volt	14/11
0-3 RF Amp.	7/11
0-40 Amp.	14/11
30-0-30 Amp.	35/-

Postage: Vic., 1/7; Int., 3/5.

PORTABLE ELECTRIC GRAMO

English Motors in Portable Leatherette Carrying Cases:—
Standard 78 R.P.M. £5/19/6
Standard & Microgroove combined £7/19/6

"RECORDEX" RECORD RACKS

The new improved gramo record rack, holds 25 10-in. or 12-in. records. Complete with index card and gummed identification numbers for records.
Price, as illustrated 17/9

BARGAIN VIBRATOR POWER SUPPLIES

32V to 250 Volt Vibrator Power Supplies or DC Filtered.
6 Volt to 150 Volt, as above.
Reduced to 79/6

Postage: Vic., 3/3; Inter., 7/2.

TEST OSCILLATOR

The new Q Plus Spotoscillator, accurate alignment of IF Transformer, 455 Kc, only 82/9, inc. Sales Tax.
Post: Vic., 1/7; Int., 3/5.

PICK-UPS

GOLDRING PICK UP

GOLDRING 150 3 way Pick-up for 33.1/3, 45 and 78 r.p.m.
As illustrated.
Reduced from £7/18/- to 39/6

Postage: Vic., 1/1; Inter., 1/1.

STOP PRESS BARGAINS

Valves:—

Type 7A6. All brand new	7/11
1Q5	8/11
954	7/11
6R7G	9/11
25L6	9/11

Resistors:—5 watt.
Wire Wound.
350 ohms, 500 ohms, 750 ohms, 1,000 ohms, 1,500 ohms .. .. 1/- each

English Loctal Sockets, cut to 3d each
5BP1 Cathode Ray Tube Sockets, 2/6 each
Standard Speaker Transformers, 200 ohm to 2.3 Voice Coil .. .. 2/11 each

CONDENSERS, electrolytic.

8 mfd 350 Volts	1/11
14 mfd 350 Volts	1/11
24 mfd 350 Volts	2/6
24 mfd 600 Volts	4/11
300 mfd 12 Volt	9d

Postage 5d.

CERAMIC VALVE SOCKETS .. 1/3 each
Postage 5d.

ASSORTED I.R.C. RESISTORS.
Bags of 100 .. .. 7/6 bag
Postage 3d.

12 Volt Sync. Split Vibrators	4/11
12 Volt non-synch.	4/11

Postage 5d.

Crystal Set Coils 3/11
Postage 5d.

Mantel Cabinets, Bakelite	7/11
Polished Wood Cabinets	9/11
Radiogram Cabinets, from	£8/19/6

(Must be inspected)

30 Henry 100 mA. Chokes, only	12/11
Powerful Magnets	1/11
Jones Type Extension Plug and Socket	1/11

WRITE OR CALL FOR FREE COLOR RESISTOR CHART

290 LONSDALE STREET, MELBOURNE. FB3711

have been taken to it in a straight line.

Slow motion or vernier dials are very hard to obtain. However, their use is essential for easy tuning.

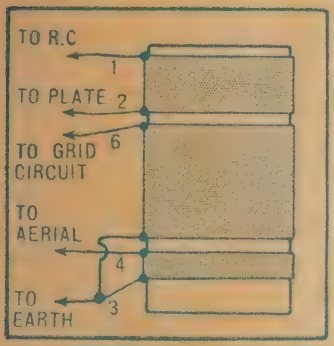
Many old broadcast receivers used such dials. They would work quite well on a small set like ours. Disposals stores are also a prolific source of such items.

The photograph shows a type R5 dial of more recent vintage, consisting of a heavy brass plate, rim-driven by a small rubber grommet on the shaft of the tuning knob.

A set of six coils provides complete coverage from the broadcast band to about 30 mc., depending on the layout.

With the tuning condenser suggested, there is a considerable overlap between the individual bands.

Alternatively, a smaller tuning condenser could be used, which would reduce the overlap on the low frequency end of the bands and at the same time provide a certain amount of bandspread. There is,



A diagram showing how the coils are connected to the pins of the former

however, the danger of not being able to cover the whole of the broadcast band in one sweep.

Of course, if you are interested mainly in short-wave and amateur stations, restricted broadcast coverage is not important, and the smaller tuning condenser will give better bandspread on short waves.

Having decided to use new components, we may as well buy a set of coil formers, although discarded valve bases do a very good job on the smaller coils.

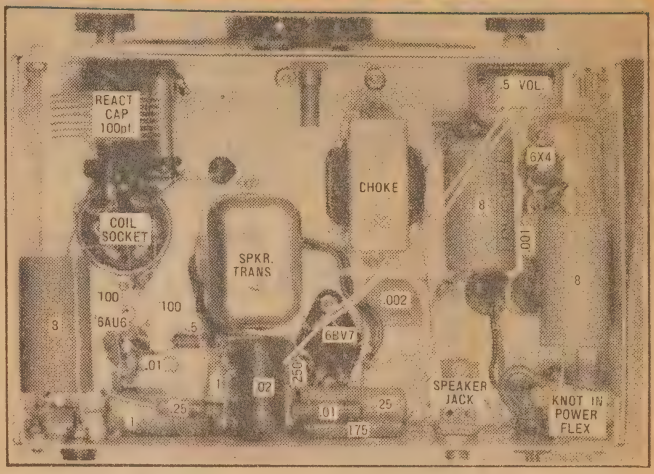
There are five connections to be made to the coils which determine the number of pins used. Formers having more pins can be used simply by leaving the surplus pins unconnected. We used some 1¼in six-pin formers which we happened to have on hand. Winding data and pin numbers are given for coil formers of this type. Depending on the number of pins, a suitable socket will have to be mounted on the chassis.

A few words here about coil winding would not be out of place.

Take the former and mark out the approximate space required for the windings, starting with the aerial coil at the bottom. (See diagram.)

Drill a 1-16in hole for each end of each winding. To make easy connection, drill these holes in line with the respective pins. To make soldering easier, the ends of the pins should be cleaned with a sharp drill of

UNDERCHASSIS VIEW OF WIRING



This photograph shows the exact position of nearly every component in the receiver. There is plenty of room for them all.

slightly larger diameter than the hole. Then clean the enamel off the end of the wire and thread through the hole in the former and the pin.

After putting on the required number of turns, cut the wire to the necessary length, clean the end and push it through the pin. When all the windings are in place, the ends can be soldered into the pins.

Many coil formers on the market today are made of a thermoplastic compound which melts if excess heat is applied to it. It is therefore important that the soldering be done

The components above the chassis may be identified here. The coil shown covers the broadcast band.

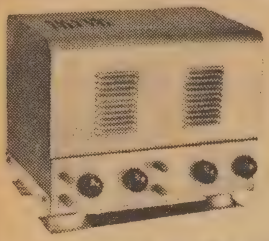
A.C.E. RADIO

PHONE LA 3845

136 VICTORIA RD. MARRICKVILLE, SYDNEY, N.S.W

EVENINGS and WEEKENDS: "KALUA", COLLAROY ST., COLLAROY—XW5956

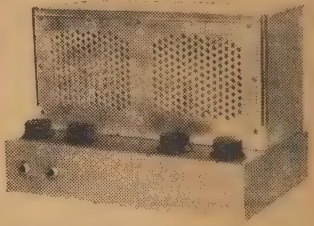
DULWICH HILL, UNDERCLIFFE, EARLWOOD, TRAM AT DOOR. STOP No. 42.



AMPLIFIERS

FROM

£12/19/6



P.A. RANGE

240V AC OPERATION

6 VALVE 10 WATT £12/19/6
6 VALVE 25 WATT £22/17/6
6 VALVE 40 WATT £29/17/6

BATTERY OPERATION

5 VALVE 10 WATT 6V DC £15/17/6
7 VALVE 12 WATT 12V DC £17/17/6
7 VALVE 25 WATT 12V DC £22/17/6

12V BATTERY & 240V AC OPERATION

7 VALVE 12 WATT £19/17/6
7 VALVE 25 WATT £26/17/6

HIGH FIDELITY RANGE

Complete with the amazing New Jensen A.U.53 Twin Cone Speaker. Cross over network. Mounting ring and spider. Frequency response 50 to 12000 cycles.

Separate Base and Treble Boost

6 WATT PP TRIODE OUTPUT £26/17/6
12 WATT PP BEAM POWER OUTPUT £27/17/6
15 WATT PP TRIODE OUTPUT £34/17/6
20 WATT PP BEAM POWER OUTPUT £35/17/6

TABLEGRAM

5 VALVE RECEIVER. Using latest miniature valves. 3 SPEED PLAYER UNIT with turn over crystal pickup for standard or microgroove recordings. £33/17/6

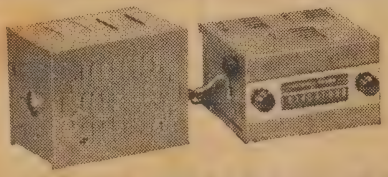
COUNTRY SPECIAL!

6 Valve Receiver with tuned R.F. stage giving extra sensitivity and selectivity for difficult locations. £36/17/6

D.C. to 240V. A.C. INVERTORS

ELECTRIC SHAVER INVERTORS 6 or 12V £5/7/6

Operate your electric 4, 5 or 6 valve radio in car, caravan or boat. 6 volt 40 watt. 12 volt 60 watt. 32 volt 60 watt £7/17/6



CAR RADIO £27/17/6

A FULL RANGE OF CAR RADIOS TO SUITALL PURSES AND PURPOSES. Outstanding performance. Simple installation. Complete with aerial to suit you. Side, windscreen or cowl mounting. All installation, accessories guaranteed.

5 VALVE £27/17/6
6 VALVE £31/17/6
8 VALVE £41/17/6

5 VALVE A.C. OR 6 OR 12 VOLT UNIVERSAL £32/12/6
6 VALVE UNIVERSAL .. £36/17/6

Also the amazing new dry battery Portable and Car Radio. 5 valve £27/17/6

ALSO AVAILABLE SPECIAL FREQUENCIES. TRANSMITTERS OR RECEIVERS. For Communications, Bush Fire Control, Small ships, Etc. Prices on application. State frequency and operating voltage.

with a very hot soldering iron in as short a time as possible, to avoid melting the former. It is advisable to hold the pin with a pair of pliers while soldering to conduct excess heat away from it.

BROADCAST COIL

Try the coils to see that everything is working correctly, and adjust them for best results. The windings can then be cemented into place with some lacquer or Tarzan's Grip.

There are commercially-made B/C Reinartz coils available which will work quite well with our receiver. This type can be connected into an old valve base with stiff wires and plugged into the coil socket. The rear view of the receiver shows such a coil plugged in. They give the same results as the hand-made type.

The connections to the coil socket should be kept as short as possible for good performance on the higher frequencies.

COIL DATA

All coils are wound on 1¼ diameter plug-in formers or valve bases. Though actual gauges are quoted, some latitude is possible particularly on the shortwave coils, where space is not so critical. All windings are wound in the same direction.

BROADCAST BAND

Grid winding: 100 turns 29 B&S close wound. Primary: 15 turns of 29 B&S, spaced ¼in from earthed end of grid winding. Reaction: 40 turns 36 B&S spaced ¼in from grid end.

BAND TWO (1.2 to 4.4 Mc)

Grid winding: 38 turns of 24 B&S enamel close wound. Primary: 11 turns of 29 B&S enamel spaced ¼in from earthed end. Reaction: 27 turns of 29 B&S enamel spaced ¼in from grid end.

BAND THREE (2.35 to 8.7 Mc)

Grid winding: 16 turns of 24 B&S enamel, spaced to occupy ½in. Primary: 7 turns of 29 B & S enamel spaced 1⅛in from the earth end. Reaction: 8 turns of 29 B&S enamel spaced ¼in from grid end.

BAND FOUR (4.6 to 17.6 Mc)

Grid winding: 8 turns of 24 B&S enamel spaced to occupy ½in. Primary: 2 turns of 29 B&S enamel spaced ¼in from earthed end. Reaction: 3 turns of 29 B&S enamel spaced ¼in from grid end.

BAND FIVE (9 to 32 Mc)

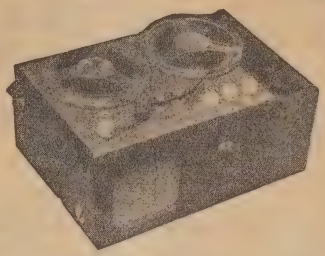
Grid winding: 3½ turns of 18 B&S (approx.) enamel, spaced to occupy ⅜in. Primary: 2 turns of 29 B&S enamel spaced ⅛in from earthed end. Reaction: 2 turns of 29 B&S gauge spaced ⅛in from grid end.

On the short wave bands we identified no less than 40 stations transmitting from 8 to 10,000 miles away. Using only 8ft of wire as an aerial, we had to make liberal use of the volume control on the broadcast band. Using a long aerial on this band tends to spread the stations slightly, particularly if they are close at hand.

This can be remedied by spacing the aerial winding further from the secondary, or reducing the number of aerial coil turns to decrease the coupling to the grid coil.

NOTE: NEW TELEPHONE NUMBERS: BM6138, BM2350

In 1955 as before



'NOVA'

NOVA

leads in

THREE SPEED

(7½-3¾ and 1⅞in)

KITSETS—DECKS—RECORDERS—TAPE-GRAMS

FIRST TIME ON ANY RECORDER THE NEW

NUMBER PLACE-FINDER

Gives exact location of any spot on the tape anywhere on the full FOUR HOURS of recording.

ONE-KNOB CONTROL: A child can operate it.

The "NOVATAPE" equipment is the most advanced design—incorporating all the features a 1955 recorder should have. You will be amazed if you compare it with other makes on the market. So, before choosing another recorder, ask for a demonstration of a "NOVATAPE" without obligation.

Tape Recording Heads for speeds to 1⅞in/sec.

Heads for striped film 8, 9.5 and 16mm.

REMEMBER:—"NOVA" is the ONLY firm making commercial tape-equipment, used in recorders and Tape-grams available to the self builder in Kitform.

TELEPHONE AMPLIFIER AND PHOTOFLASH KITS AND

COMPLETELY BUILT UP UNITS

As described in Radio and Hobbies.

TRANSFORMERS, COILS

Before purchasing any transformer, choke, etc., contact "NOVA" for a quotation on your needs. We will manufacture any transformer standard or special to your specification WITHIN A FEW DAYS.

From Little Hearing-Aid Transformers to the ORIGINAL "Williamson" or "Leak" on English, 28A Supersilcor.

NO JOB TOO SMALL; NO JOB TOO LARGE!

VARIABLE TRANSFORMERS, RE-WINDS.

"NOVA" TAPE-TO-DISC SERVICE

"NOVA" will make Standard and Microgroove Records of any tape. Please send S.A. envelope with 3d. stamp for details.

Terms on low deposit.

For further details contact your dealer or

"NOVA"

311 SUSSEX ST., SYDNEY

NOTE: New Telephone numbers:

BM6138 — BM2350

OPEN SAT. MORN. AND WEEKDAY NIGHTS.

CUT OUT HERE 1/55

Please send without further obligation, details of .....

NAME .....

ADDRESS .....

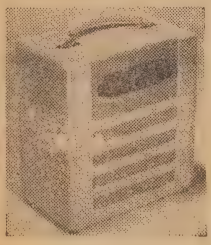
.....

I enclose LARGE self-addressed envelope and 6d. in stamps.

Outdoor Days — are Portable Days!

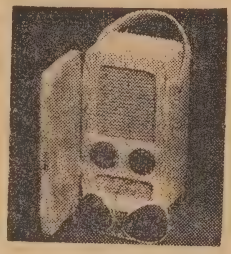
MAKE YOUR OUTDOOR ENJOYMENT COMPLETE WITH A PORTABLE YOU CAN BUILD YOURSELF!

Electronic Parts offers you a range of "R & H" designed portable kits to suit your need and your pocket. Give yourself the thrill of building your own portable. You save money, too, because a high quality E.P. kit is less than two thirds the cost of a similar commercial set. E.P. kits are complete in every detail, including circuit building diagrams, and highest grade components. Post coupon for free kit set catalogue.

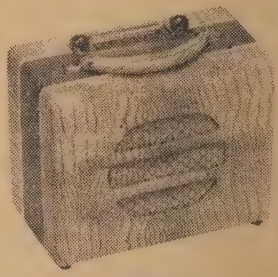


JUBILEE PORTABLE
6 Valve portable with R.F. stage and built in A.C. power supply. Operates from batteries or A.C. power mains.

SENIOR PORTABLE
5 Valves, with R.F. stage and 7in Speaker. In suit case style cabinet — a really high grade set.



CARRY-SET
4 Valve personal portable in smartly styled cabinet. Small, highly efficient — quite outstanding in personals.



RAMBLER
Smart attractive portable in leatherette covered cabinet, highly efficient.

.. And Hi-Fidelity Enjoyment with a PLAYMASTER

There's a Playmaster kit (or completely built unit) to suit every requirement of the hi-fidelity enthusiast. These and other P.A. Amplifiers described in our free kit-set catalogue.

- Amplifier No. 1 (5 Valves 18 Watts).
- Amplifier No. 2 (5 Valves 10 Watts)
- Amplifier No. 3 (3 Valves 4 Watts)
- Amplifier No. 4 (3 Valves 4 Watts)
- Amplifier No. 5 (5 Valves 10 Watts)
- Amplifier No. 6 (5 Valves 8 Watts)
- Amplifier No. 7
- Vibrator Amplifier (6 Volt)
- Standard Amplifier and Tuner.
- Tuner No. 1 (2 Valve D/W & B/C)
- Whistle Filter
- Tuner No. 2 (3 Valve T.R.F. with Filter)
- Wide Range Tuner (1900 K.C. with Filter)
- Wide Range Tuner No. 2 (455 K.C.)
- Control Unit No. 1 (1 Valve with Vol. Cont.)
- Control Unit No. 2 (DeLuxe Model)
- Control Unit No. 3 (Special Type)
- Control Unit No. 4
- G.P. Junior Amplifier.

LIGHTWEIGHT
4 Valve portable, in smart cabinet. Latest release — "R & H" circuit. Highly efficient. Also available as 5 Valve. Uses R.F. stage.

ELECTRONIC PARTS PTY. LTD.
E. S. & A. BANK BUILDING,
206 BROADWAY, SYDNEY, N.S.W.
PHONE: MA1661.
Telegrams: ELECPARTS. SYDNEY.

SEND FOR FREE CATALOGUE

ELECTRONIC PARTS PTY. LTD.
E. S. & A. BANK BUILDING, Cnr. Broadway & City Rd., Sydney. Phone MA1661.
Dear Sirs,

Please send me, without obligation, your kit-set catalogue.

Name .....

Address .....

USING PHOTOFLASH FOR COLOR

We have recently had the opportunity of testing our original high voltage Electro-Flash unit with Kodachrome and the data obtained from these experiments should be of considerable interest to other users.

BEFORE exposing the color film we had only the vaguest idea of the correct exposure and there was little published data which would suit the case. Some professional photographers maintained that the light was useless anyway, being of the wrong color temperature, in spite of the lamp manufacturers claims to the contrary.

Having made extensive experiments on black and white film we referred to some of this earlier data, selected a well exposed negative and, by comparing the published speeds of the black and white and color film, calculated a guide number for the latter. In making these calculations we assumed that there would be less tolerance to under exposure in color than in black and white and this was the reason for choosing a negative somewhat more exposed than might be necessary for black and white work.

The guide number worked out at 27, this being on the basis of a 33 mfd capacitor charged to 2500 volts. Assuming a 28 mfd capacitor we suggest a guide number of 25.

The results obtained by using this number were excellent and it is difficult to visualise any improvement. Any suggestion that the light was incorrect in color was completely refuted and the makers claims appear to be fully substantiated. Delicate flesh tones were particularly well rendered.

The unit was used both indoors and outdoors, in the latter case being used to supplement daylight when the latter was failing or when the subjects were back lit. In all cases the results were perfectly satisfactory.

GOOD SHOTS

When used in this way it makes possible color shots which would be impossible in the ordinary way, since the limited latitude of color film calls for extremely even lighting. In a backlit shot the background will be badly overexposed if the subject is adequately exposed, or the subject underexposed if the background is correctly exposed.

To use flash with daylight it is necessary to give two exposures at the same time, one for the flash and the other for the daylight. This is not as hard as it sounds, since the shutter can be used to control the daylight exposure without effecting the flash, the latter being so much faster than the fastest shutter speed.

First calculate the stop required or the flash, using the guide number in the usual way. Then calculate the daylight exposure required and select a shutter speed which will give this exposure when used with the selected stop.

CAPACITOR CHARGE

Considering the low speed of color film and the limited latitude it is important to see that the capacitor is fully charged before firing. If working from an accumulator see that this is fully charged. If you use dry batteries it would be advisable to use fresh ones, even if the existing ones are retained for black and white work.

We have not yet had an opportunity to test the low voltage Electro-Flash with color film, though some reports suggest that it can be used with a similar guide number. However, in the absence of specific data this can only be regarded as a rough guide.

GEIGER COUNTERS

Nuella Portable Counters

Aural Indication Type £26/10/-
Aural Neon Flash Type £32/12/6
Meter Reading Type £53/10/-

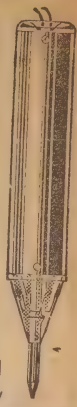
NUELLA ELECTRONICS
115 Alice St., Sans Souci. N.S.W.
Telephone: LW6778.

AWA RONETTE
MICROPHONES & ACCESSORIES

Type C53
£4/19/1
Hand or stand mounting, omnidirectional, black plastic housing and hand grip. Ideal for tape recorders and similar applications.

NICHOLSONS LTD.
BARRACK ST., PERTH.
and leading wholesalers

PROBE HOUSING



used with VTVM's signal tracers etc. Heavy chrome-plated brass with moulded Polystyrene and fittings.

Retail Price 19/6

Distributors everywhere!

Watkin Wynne Pty. Limited
173 Pacific Highway, Nth. Sydney

INSTRUMENT CASES

Wholesale and Trade only

All Standard and Radio Hobbies Cabinets obtainable at all leading Radio Distributors.

We specialise in All Classes of Covered Cabinets — Instrument, Portable and Mantel Radio Cabinets in either Leather or Leatherette.
Interstate Representatives: J. H. Williams and Co., 50 William St., Melbourne; B. L. Andrews, 144 Gawler Place, Adelaide, S.A.; H. M. King and Sons, King George Square, Brisbane, Qld.; Affiliated Agencies, 92A Barrack St., Perth, W.A.; L. V. McPartlan, 223 Liverpool St., Hobart, Tas.

GIBBONS & DENHAM
15 FARIOLA ST., NORTH LIDCOMBE YX1456

AWA RONETTE
MICROPHONES & ACCESSORIES

Type R572
£18/9/10
(High impedance)
Type R572/L
£22/9/4
(Low impedance, 200 ohms) duo cell omnidirectional
Other types also available from

Noyes Bros.
252 ARGYLE STREET, HOBART.
and leading wholesalers

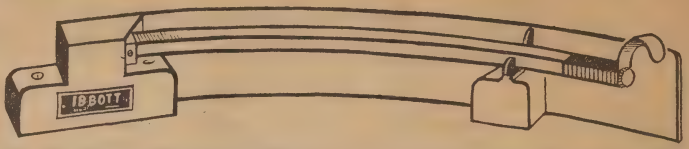
IT'S HERE — — — **The Australian Guide to**
TELEVISION
5/- Post Free from
ELDRIDGE ELECTRONICS 530 Hawthorn Rd., Sth. Caulfield, S.E.8, Vic.
WORTH A POUND A PAGE

Pocket Book Weekly
On Sale All Newsagents

MARCO · proudly presents ....

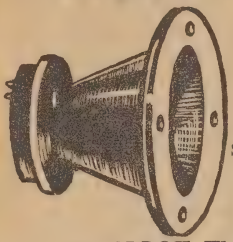
... the IBBOT PICKUP

equal to the World's best at a fraction of their cost!



Distortionless reproduction, flat 20—20,000 c.p.s Knee-action Stylus for lowest pinch effect. Tracking weight only 5 grammes either head. High impedance and out-put, needs no transformer — Only £12/16/- plus postage with 2 heads and normal or transcription arm.

★ Sound Perfection by Ibott



... the IBBOT TWEETER
with the greatest range
(flat 2½—20 kc.)
highest transient response.
—£7/10/- plus postage.
Crossover networks available if required.

and remember the MARCO TAPE TO DISC SERVICE
—Why keep those wanted items on Tapes?

Have anything faithfully copied on to Microgroove or Standard records (unbreakable), by Post or Appointment.

Send stamp for details of anything advertised.

MARCO RECORDING STUDIO, Regd.

192 TOORONGA RD., GLEN IRIS, S.E. 6.
MELBOURNE.
Phone UY1812

"for everything in Quality Sound!"
Sole Vic. Agents for Bradmatic & Reflectograph
Tape Decks & Complete Recorders

SHIPMENT SOLD OUT! MORE ORDERED. BOOK NOW!

"GELOSO" SIGNAL SHIFTERS

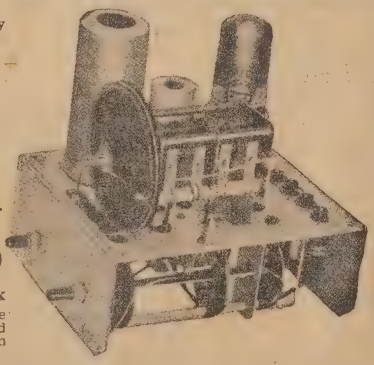
Valves and Power Supply not supplied with Unit.

GELOSO SIGNAL SHIFTER and calibrated dial. Cat. No. 4/101

£10/4/9

Price inc. Tax

Please include Exchange and Freight with Orders.



- **Instant change of Frequency on any band by coil switching.**
- **Controllable output over the entire tuning range.**
- **Single control full band spread on each band.**
- **Capacitive output.**
- **Utmost frequency stability (plus or minus 200 c.p.s. on all bands).**
- **No plug-in coils required.**
- **Laboratory tested.**
- **Power Supply required: 400 volts at 32-54 Ma.**

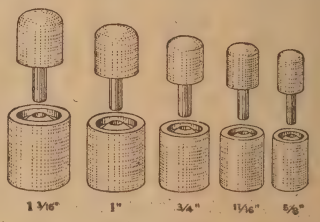
"Woden" Mod. Transformers

Write for a copy of the Impedance Chart.

Type UM1 30 watt .. .. £6/9/11 (inc. tax)
Type UM2 60 watt .. .. £9/17/2 (inc. tax)
Type UM3 125 watt .. .. £12/2/5 (inc. tax)

IMMEDIATE DELIVERY

"WILLIS" CHASSIS PUNCHES



Made especially for the Radio and Electronic Engineer and Constructor. Guaranteed 10,000 holes.

3/8in. 19/-	3/4in. 23/3
1/2in. and 5/8in. 19/11	1in. 29/10
11/16in. 21/6	1-3/16in. 33/2

Established over 90 years.

WILLIAM WILLIS & CO. PTY. LTD. **Phone: MU2426**

428 BOURKE STREET — — MELBOURNE, C.1

FROM THE SERVICEMAN WHO TELLS

Dealing with customers is sometimes a bigger problem than tracing a cranky intermittent and I have a few words to say on this before discussing technical matters. On the technical side there is an unusual distortion problem and a rather unique case of microphony.

MY customer problem is really a "winge" — and one that I have aired before — which is brought on periodically by a certain type of customer. As I say, I have mentioned it before, but a recent case prompts me to raise it again, particularly for the benefit of beginners in the servicing game.

It concerns the "smart" type of customer who believes, firstly, that all servicemen make exorbitant charges, and, secondly, that he is smart enough to beat the serviceman and get the job done for much less than anyone else.

SMART TYPES

These individuals have various approaches, but the most common one is that they don't want any new components fitted to the set without being advised, because they can get them either (1) "cheap", (2) "second-hand", (3) "wholesale" (magic phrase), or (4) "free".

Just how they manage to achieve these rather remarkable savings could call for some awkward explaining, particularly the supply of "free" parts. I have no doubt that the stock sheets of many a large factory or government department refuse to balance because someone has scored some "free" parts for his own private equipment.

But whether they can obtain their parts free or cheap is really beside the point. The real point of the matter is that the cost of components usually represents only a small part of the total cost of servicing a set. Most of the cost involves the serviceman's time.

Replacing even the smallest component in a set involves more time than most people imagine. Usually the set has to be picked up and transported to the shop, and, even if it is delivered by the owner, it still has to be removed from the cabinet, dusted to the point where it is fit to work on, and then checked to confirm the owner's complaint, or even establish what the complaint is supposed to be.

YOUR TIME

Then the cause has to be found, the faulty component replaced, the set checked again, and, ideally, aligned, replaced in its cabinet, and either returned to the customer or the customer notified that it is ready.

Even when presented in condensed form like that, it is obvious that a fair amount of time is involved. In fact, and as any serviceman will testify, it is seldom that everything runs along smoothly and according to plan. Quite apart from the problems which frequently occur in finding the trouble, there is the complicated business of actually removing the faulty part and replacing it with a good one.

While no particular skill is involved (relatively speaking, anyway), it cannot be achieved by waving a magic wand. Someone has to spend time delving into the set's innards, clearing a path through good components to reach the faulty one, then, after it is replaced, putting all the good components back.

All of which boils down to the fact that there are not many sets which can be disposed of under a couple of hours' total handling time, even if they are relatively simple. When the going is tough or special components have to be chased, you'll chalk up a lot more time before the job is finished.

And time is worth money. If you feel inclined to quarrel with the price the serviceman puts on his time, look at it this way. Assuming that there is a place in a particular community for a serviceman, then surely that community owes him a living at a standard not less than that of, say, the ordinary skilled worker in that community who would earn the basic wage plus a margin for skill.

A FAIR THING

Frankly, I can't see how anyone can quarrel with that. Would the ordinary skilled worker, including, perhaps, the "smart" fellow who is so keen to outwit the serviceman, work for any less? I think not. In fact, at the merest suggestion of such a thing, unions and trade organisations would be up in arms, ready to fight to a finish for their rights.

If, then, we grant that he is entitled to at least such an income, it is not hard to work out how much profit per day, and per hour, he will have to make in order to achieve that. And note that I say profit. It is not sufficient that he charge that amount, for he will have many expenses to meet.

You, as the customer, will naturally expect him to have a shop where you can contact him during normal business hours. You will expect him to have a telephone to be on call, and a truck to collect the faulty set and deliver it back when repaired.

This means that he must pay shop rent and telephone rent, buy and run a truck, as well as allow for its depreciation. If you add that up you will find that it's a lot more than chicken feed.

PETTY EXPENSES

In addition, there are such expenses as light and power, new workshop equipment (if he is to keep up-to-date), solder and hookup wire and a host of minor items, of which it is almost impossible to keep a detailed account, but which are always nibbling at the petty cash box.

Yet all these expenses are incurred on behalf of his customers. Not until all those are paid will there be a penny for his own salary. Is it any wonder, then, that he must put a definite charge per hour on his time, and that this figure may, at first glance, appear unduly high?

In addition to this, it is as well to remember that he has all the worries associated with running a business. Unlike the other fellow, he cannot leave the worrying to the "boss". He cannot discard his day's troubles when he takes off his overalls at 5 o'clock. Frequently he will work long hours, for which there is no overtime in the normal sense.

INVESTMENT

His business also represents on investment. With stock and plant, any such business worthy of the name will call for a substantial outlay. And, to cap it all, the Income Tax Department will demand that he pay his income tax in advance!

For all this we have merely allocated him a profit equal to an average weekly wage. Would you, "Mr. Smart Guy", do all that for wages only?

I'll bet you wouldn't!

And to the ordinary customer who, although he may not try to beat down the price, may sometimes flinch when he has to pay out several pounds for an overhaul, I would say this: Have you ever calculated the cost per week to keep your radio in running order? If you have, I think you must agree that it is very moderate.

When we consider that many sets run for years without a penny being spent on them it would not be unreasonable to suggest that one service call every two years is a fair average. And even if such a call cost £5, the running cost is still only of the order of sixpence per week.

Surely that won't break you!

MY METHOD

Finally, there is the question of how to deal with the "smart" customer. I mean the really nasty, objectionable type who feels that, having supplied the parts, you ought to put them in for nothing.

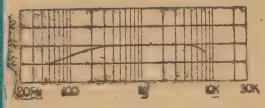
First, I make sure that every minute I put into working on the set, or anything associated with it, is charged for at the normal hourly rate. In this way I stand to lose only the small profits on the components involved.

Secondly, I take him at his word and advise him of the parts he needs to acquire, except that, if he warrants the full "treatment", I only notify him of one part at a time. Thus, if a preliminary test shows a faulty valve, I advise him of this and point out that I can make no further tests on the set until I have it. (Of course I could test the set with a valve from my stock, but why should I when he is not prepared to buy it?)

When he supplies the valve, I check the set further, possibly finding that some new electrolytics are needed. Again the owner is advised and, if there is any query about any other components being needed, I politely

FERGUSON — FOR ALL YOUR AUDIO OUTPUT TRANSFORMER REQUIREMENTS

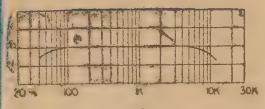
PUBLIC ADDRESS RANGE
50-8000 C/S — 2 dB



This range is designed for use with public address systems, factory music while you work, etc. A small section of our extensive range is presented below.

Code No.	Watts	PRIM. Z.	SEC. Z.
OP-1	10	5000, 2500 SE	12.5, 8, 2.3
OP-1A	10	5000, 2500 SE	500
OP-2	15	5000 PP	12.5, 8, 2.3
OP-3	15	6600 PP	12.5, 8, 2.3
OP-4	15	10000 PP	12.5, 8, 2.3
OP-11	25	6600 PP	500, 250, 125
OP-12	25	10000 PP	500, 250, 125
OP-15	32	6600 PP	500, 250, 125
OP-16	32	10000 PP	500, 250, 125
OP-37	80	6400 PP	500, 250, 125

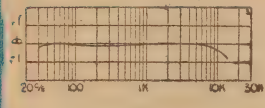
MEDIUM FIDELITY RANGE
40-12000 C/S — 1 dB



This range has been especially designed for use with the Rola 12-OX speaker. These transformers are especially suitable for use with triodes.

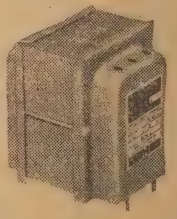
Code No.	Watts	PRIM. Z.	SEC. Z.
OP-112	6	10000 PP	2
OP-113	6	5000 SE	2
OP-117	6	5000 PP	2
OP-118	6	8000 PP	2
OP-119	6	6600 PP	2
OP-183	6	7000 SE	15, 2

HIGH FIDELITY RANGE
30-15000 C/S — 1 dB

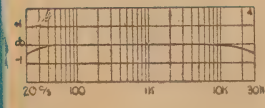


These transformers are primarily for use with Goodman and other extended frequency response speakers. Section below is only small part of our range.

Code No.	Watts	PRIM. Z.	SEC. Z.
OP-22	10	3250 SE	500, 25, 2.3
OP-23	10	3250 SE	12.5, 8, 4, 2.1
OP-19A	15	5000 PP	12.5, 8, 2.3
OP-19B	15	5000 PP	500, 250, 125
OP-21	15	8000 PP	500, 250, 125
OP-62	15	10000 PP	500, 125
OP-63	15	10000 PP	15, 3.75
OP-64	15	10000 PP	12.5, 3.125
OP-65	15	10000 PP	8.4, 2.1
OP-51	20	4500 PP	15.5, 12.5, 8.6, 2.8, 2



SPECIAL HI-FI RANGE
20-30000 C/S — 0.5 dB



These transformers are for use in the Williamson Amplifier, and fulfil every requirement specified by D. N. T. Williamson.

Code No.	Watts	PRIM. Z.	SEC. Z.
OP25/500	15	10000 PP	500, 125
OP25/250	15	10000 PP	250, 62.5
OP25/40	15	10000 PP	40, 10
OP25/16	15	10000 PP	16, 4
OP25/15	15	10000 PP	15, 3.75
OP25/12	15	10000 PP	12, 3
OP25/10	15	10000 PP	10, 2.5
OP25/8.4	15	10000 PP	8.4, 2.1
OP-66	15	5000 PP	8.4, 3.7
OP-67	15	5000 PP	15, 6.5

Ferguson Transformers Pty. Ltd., Ferguson Lane, Chatswood—Phone JA8491. Available from retailers in every State

explain that it is impossible for me to be sure on that point until the set is tested with the new electrolytics.

And so it can go on, but he dare not complain. I am only acting on his own instructions, and he must play out the farce to the end.

One such bout of this treatment will cure even the smartest "smart guy".

And so to matters technical.

I experienced two unusual cases of distortion this month. They were quite different in actual cause but both gave symptoms which, at first hearing, could have been mistaken for faulty speaker alignment. In fact, both owners complained of distortion, along with other faults which were rather more definite.

NOISY CONTROL

In the first set there was, as well as the "—funny rasping noise in the speaker" (to use the owner's own words), a noisy volume control. This the owner had also mentioned, but a check on the bench showed his statement to be conservative, to say the least. In fact, the thing was intermittently open circuit cutting out altogether at certain spots and coming good again with a series of crackles a few degrees further on.

How people put up with these things for as long as they obviously do is beyond me.

But of the "funny noise" in the speaker I could find no sign. I tried it at various levels and even tried exerting light pressure on the frame, just in case the method of mounting in the cabinet had any bearing on the trouble. The result was completely negative, and I would have passed the speaker as 100 pc OK.

At this juncture I realised that I had only the owner's word for the fact that the trouble was actually in the speaker. For all I knew it might be almost any kind of intermittent distortion, because most people can only associate a sound which they hear in the speaker with the speaker itself. The idea that such unwanted noises could be generated almost anywhere else in the set is something they simply cannot grasp.

RESEARCH

One possibility which occurred to me was that the extremely touchy volume control could, in certain circumstances, be so set that it was just on the verge of crackling and that the vibration from the speaker was sufficient to set it off. I tried to create this condition but without much success, so I shelved that idea for the moment and decided simply to let the set run and see what happened.

Accordingly, I found myself another job, and hoped I wouldn't have to wait too long for some sign of the trouble.

Sure enough, after about 15 minutes, the set suddenly developed a most objectionable distortion. The abruptness of the change was quite marked; one moment the set was playing normally, the next it was rasping and crackling as though the entire voice coil assembly had fallen to pieces.

At this stage it would have been easy to assume that the speaker really was out of alignment, but there were two points which made me doubt this. One was the extremely rapid change — almost as though a switch had been operated — and the other was the nature of the sound.

Although, in general, it sounded like the usual rasping which accompanies a mis-aligned speaker, there was also a sharp crackling characteristic which was more suggestive of an electrical fault than the simple rubbing of the voice coil against the magnet.

In addition, checking the cone movement with the fingers revealed no obvious scraping, yet the noise persisted. I listened to it again for a minute or so, and then decided that the crackling noise could be caused by an intermittent open circuit in the speaker voice coil.

It was this thought that gave the clue to the trouble. I slipped my finger behind the cone and exerted gentle pressure on the two flexible leads connecting to the voice coil. One offered virtually no resistance to my pressure and came away from the eyelet which formed the insulated terminal on the frame.

Careful examination of the free end of the lead revealed a small patch of solder with a rough surface and having all the appearance of a dry joint. It was not possible to examine the eyelet very closely, but as far as I could see, it was in a similar condition. Apparently the end of the lead had simply been resting against the eyelet making intermittent contact, subject to the whim of the speaker cone vibration and the handling of the set.

SOLUTION

A hot soldering iron and a spot of flux and solder soon restored the connection — and the speaker's original performance. Now that the faulty volume control had been absolved from blame, as far as the distortion was concerned, I replaced it with a new one and the set performed as well as ever it had.

The important point about the above case, is, I think, the fact that it would have been so easy to mistake the symptoms for those of mis-alignment and to have involved the owner in the cost of a new speaker cone. Only the fact that I actually heard the abrupt change from good to bad and that I was able to detect the different character of the distortion prevented me from making such a mistake.

The second set was brought to me mainly because of poor overall performance, the owner living in a rather difficult area where sensitivity and selectivity were more important than usual. The distortion was mentioned as a minor trouble which was just bad enough to be annoying.

When checked on the bench this trouble was definitely in evidence. It was nothing like as objectionable as the previous case, being merely a slight buzzing sound which gave the reproduction an "edgy" quality. My immediate impression was that the speaker voice coil had a loose turn.

SUBSTITUTION

To confirm this, I simply substituted the bench speaker, which proved the point by producing perfectly clear reproduction. As a cross-check I switched back to the set's own speaker, noted the buzz, and then applied gentle pressure to the frame so as to twist it slightly. This seemed to clinch it, because it wasn't hard to find a degree of twist which would clear the trouble.

Since the repair of modern speakers is definitely a job for the makers I simply removed it from the chassis and despatched it to the makers for a new cone. Then I turned my attention to the poor performance of which the owner had complained.

It did not take much testing to show that the gain of the set was down and the response rather broad. After checking the valves and voltages, without finding anything amiss, I checked the alignment. This proved to be the trouble, though how it came to be so far out is something which must remain a mystery. The owner denied that anyone had touched it, but I rather suspect that a junior member of the household might have been able to tell more than he cared.

ALIGNMENT

Anyway, whatever the cause, the fact remained that the alignment was in a very bad way, and once this was corrected the performance was quite good.

At least, it seemed OK until, in the process of handling the chassis on the bench, I gave it a fairly sharp jolt. The result was a microphonic "bong" from the speaker with all the characteristics of a microphonic valve.

I was so convinced that the trouble was a valve that I set about tapping each in turn to discover which one. But it wasn't quite as easy as that. No matter how gently I tapped each valve the result was much the same and it was difficult to distinguish between any of them.

Tapping the chassis also produced the noise and, while this did not rule out the idea of a faulty valve, it did lead me to the general area of the gang, where the whole set-up seemed much more sensitive. I steadied the gang with one hand and tried again. The noise vanished. I released the gang and it immediately returned.

I tapped the gang itself and was gratified to observe a very loud burst. Well, at least I was getting close, even though the actual cause was still to be found. A likely possibility was that the gang itself was microphonic and this is not an unusual fault. It is generally caused by one or more of the plates being poorly "staked"—the process of squeezing the plates in their respective slots in the gang shaft.

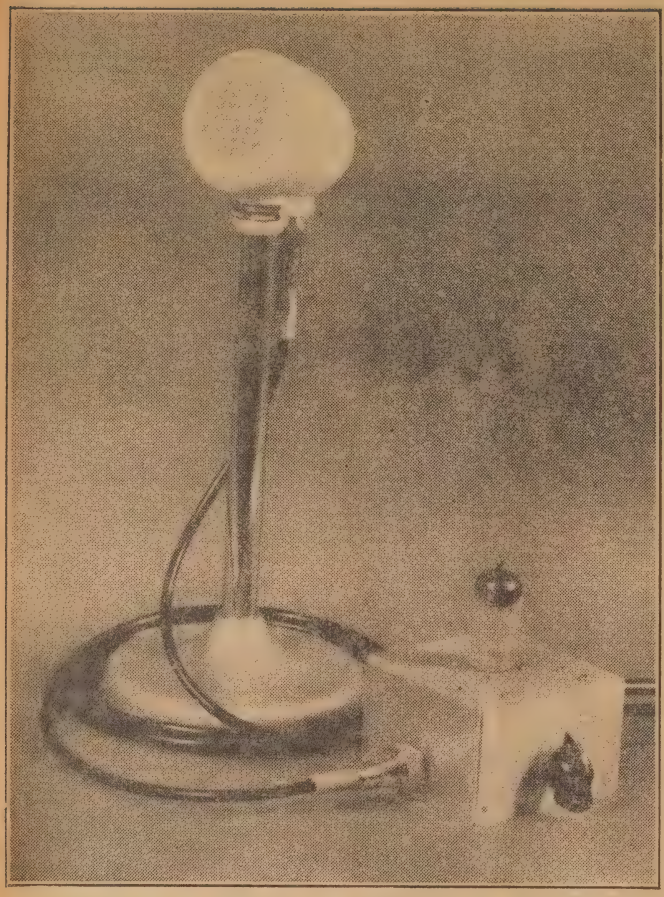
PLATE VIBRATION

When this happens a plate, or sometimes several plates, are free to vibrate and will usually respond to the sound from the speaker. If the section involved happens to tune the oscillator circuit the set will be detuned at whatever frequency the plate chooses to vibrate. The result can be distortion or even acoustic oscillation if it is very bad. This latter effect is most usual on the short-wave band.

However, to get back to my own case. I tapped each gang section in turn and decided that the aerial section was the more likely culprit. Then I probed around this section in an effort to find the actual cause. While so probing I happened to tap the aerial trimmer and brought forth a really violent burst of noise which put all previous efforts to shame.

The trimmer was of the concentric type, protected by a transparent plastic case and appeared to be securely soldered to both the frame and active terminal of the gang. With no obvious dry joints I could

(Continued on Page 95)



Some idea of the small size of the completed unit may be obtained from this picture which shows it alongside a typical microphone. The style of microphone input connector can be clearly seen, though terminals would be satisfactory in some cases. The power and audio cable can be seen at the rear of the chassis.

A MICROPHONE AMPLIFIER

Sooner or later most radio enthusiasts have need of a microphone circuit, a facility which is not always available even in the most elaborate amplifiers. Here is the description of a simple pre-amplifier unit which may be used with most amplifiers and receivers, and which may be made for a very moderate cost.

by Philip Watson

The reasons for wanting to use a microphone are varied. It may be that a local charity needs a small PA system for their annual bazaar, or a social club to help the MC keep things running smoothly. In the home it may serve as a temporary means of providing a commentary for your home movies or color slides, while those interested in amateur dramatics can derive a lot of fun from producing a "radio" play, even if it is only to entertain a few friends.

Since cost often has to be considered the natural question to ask is whether an existing receiver or amplifier may be used for this work, either by adding something to it or by selecting a suitable microphone.

Although it is possible to operate certain types of microphones, such as the carbon, and an ordinary loudspeaker "working backwards" straight into the pickup terminals of a set, there is really not much future in the idea.

These microphones achieve their high output only at the expense of quality, and for anything more than the most elementary setup it will be necessary to consider one of the better quality commercial microphones. This may be a crystal, a dynamic, or even a ribbon, according to your pocket. Since the crystal is capable of quite good performance at a very reasonable cost, it is very popular, and a logical choice.

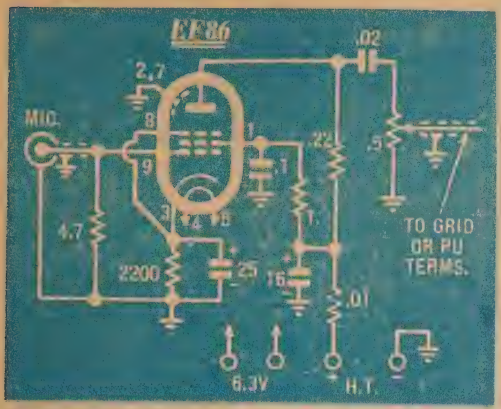
However, regardless of the type which you may finally select, it will be found that the output will be very much lower than, say, the conventional crystal pickup, and will need considerable boosting before it is strong enough to feed into the pickup terminals of a standard audio-amplifier.

NEED FOR AMPLIFIER

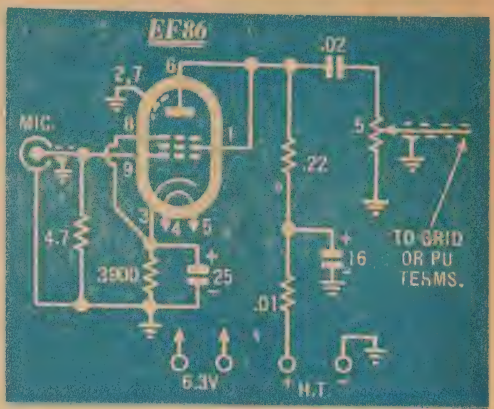
This is where our simple pre-amplifier comes in. Designed to derive its power from the main set, it consists of a single valve and the few minor components necessary to make a complete resistance-coupled stage. It may be wired either as a triode having a moderate amount of gain, or as a pentode having a much higher gain. In most cases the triode condition will suffice, but the extra gain may be useful when a low output microphone is used with a main amplifier having lower than normal gain.

Reference to the circuits will show the exact details and component values used in each arrangement and it will be noted that a volume control is included in the output of the unit. In some cases this may not be necessary, the control in the main amplifier being fully effective. In others there may be no control in circuit when the pickup terminals are used, thus making a control on the pre-amplifier unit essential.

One of the most important features of the unit is not so much the circuit employed, but the valve type.



A circuit of the pre-amp using the EF86 connected as a pentode. This will provide more than sufficient gain in most cases but may be necessary for low output microphones. A 6BR7 can also be used.



This circuit shows the alternative triode arrangement which gives less gain but which will be sufficient in most cases. As with the pentode arrangement a 6BR7 can also be used and the component values are given in the text.

This is the type EF86, which has been specially designed for work of this kind, with a view to overcoming the defects of ordinary valves when used in high-gain circuits. Another valve having rather similar characteristics is the 6BR7.

Before the advent of these valves, the design of pre-amplifiers having high gain presented many difficulties. Most ordinary valves were hopelessly microphonic and would respond to the slightest mechanical vibration by giving forth prolonged ringing noises. In some cases the system could be so sensitive that it would respond to the sound from the loudspeaker and burst into continuous howling as a result of acoustic feedback. This is not to be confused with acoustic feedback due to the microphone, and which is perfectly normal.

To overcome this, it was usually necessary to shock-mount the valves by supporting the sockets on rubber, thus complicating the mechanical features of the system.

Noise, in the form of frying and spluttering noises, was also a problem, and it frequently prevented the full gain of the amplifier from being realised.

HUM PROBLEMS

These valves could also introduce a lot of hum into the circuit, due to coupling in one form or another between the filament and the grid. Since these characteristics varied considerably from valve to valve, the successful construction of a high-gain pre-amplifier was largely a matter of luck, even though all possible precautions were taken.

With the modern valves developed specially for such applications, most of these problems have been reduced to negligible proportions. It is no longer necessary to rubber-mount the valve, while erratic noises and hum are virtually non-existent. Of particular interest is the fact that a low hum level is achieved without recourse to special centre-tapped or biased filament circuits.

Although the circuit is quite straightforward, there are a few constructional points which are worth considering in detail. The original chassis was made from aluminium and measured three inches square by two inches deep.

EASILY MADE

Most workers could make their own from these dimensions. Alternatively, any chassis of approximately the same size would do, provided it can be accommodated in the available space. Our chassis could easily be mounted in the back of a standard console cabinet.

The valve-socket is a standard miniature nine-pin type and does not require any shield. The valve itself is sufficiently well shielded internally to render an external shield unnecessary. The socket should be mounted with the pin space toward the front of the chassis, i.e., toward the input connector.

Before the socket is mounted on the chassis some connections can be made between the various pins. Pins 2 and 7 should both be connected to the central shield, and pin 8 (suppressor) should be connected to pin 3 (cathode).

The input connector is a standard microphone type unit consisting of two sections, one to mount on the chassis and the other on the microphone cable. The advantage of this device over the simpler terminal arrangement is that the microphone cable is shielded for its entire length and the chance of hum pickup is thereby lessened.

The connector we used was designed for single-hole mounting with a serrated edge to bite into the side of the chassis hole and thus prevent this portion from turning. To take full advantage of this idea, it is essential that the chassis mounting hole be the correct size. In our case, this was 3-8in.

TAG STRIPS

Two tag strips are used to mount the various minor components, one an eight-terminal type and the other a five-terminal. The five-terminal strip is mounted near the front of the chassis and supports the cathode bias resistor and the 25 mfd. midget electrolytic in parallel with it. These two components are mounted between the two end terminals and the one of these nearest the socket will be used for all critical earth-return circuits.

These will be the cathode resistor and by-pass, the earth end of the 4.7 meg. grid resistor, and the shielding braid on the lead to the grid pin. With all these connected to the terminal on the tag strip a connection is made to the earth lug of the input connector. This earthing method is desirable to avoid hum due to chassis currents.

The eight-terminal tag strip is mounted near the rear of the chassis and accommodates the HT decoupling resistor, the plate and screen resistors, the screen by-pass capacitor, and the coupling capacitor to the volume control. All the resistors are of half-watt size and there is ample room to accommodate them. Both tag strips should be wired as completely as possible before being mounted in place.

PARTS LIST

- 1 Chassis 3in x 3in x 2in.
- 1 EF86 valve.
- 1 9-pin socket.
- 1 Microphone plug and socket.
- 1 4.7 meg. ½W resistor.
- 1 1 meg. ½W resistor.
- 1 .5 meg. potentiometer.
- 1 .22 meg. ½W resistor.
- 1 .01 meg. ½W resistor.
- 1 2200 ohm ½W resistor.
- 1 25 mfd 40V electrolytic capacitor.
- 1 16 mfd 350V electrolytic capacitor.
- 1 .1 mfd 400V paper capacitor.
- 1 .02 mfd 400V paper capacitor.
- 1 8 terminal tag strip.
- 1 5 terminal tag strip.
- 1 Pointer knob.
- PTIM co-axial cable.
- 1 Octal socket (moulded type).
- 1 Octal valve base.
- Spaghetti sleeving, solder lugs, nuts and bolts hook-up wire etc.

HOMECRAFTS

RADIO IS OUR BUSINESS

100 CLARENCE ST., SYDNEY. BX 4451

ALSO 26 HUNTER ST., NEWCASTLE

the **Bib**

WIRE STRIPPER AND CUTTER

Essential for Electricians, Radio Engineers and Handymen.

only **5/11** each

GRUNDIG

TAPES
TAPE RECORDERS
ACCESSORIES

Aerial Filters
Line Filters
Crystal and
Dynamic Microphones

NEW!!

"Goldring Playgram"

The Well Known BSR GU4A 3-Speed Record Player with Amplifier and Oval Speaker Fitted in a Beautiful Moulded Carrying Case.

A Complete Portable 240V AC Record-Playing Unit for only 27 Guineas.

"Q PLUS" FERROXCUBE

Loop Stick
Replacing Loop
Aerials

23/9

Screw Type
HOLE CUTTERS

Set of Three.
Now Available
£4/17/6

ROLA SPEAKERS

Most Types Now Available

Output Transformers

By A & R Electronic Equipment

ACOS & GOLDRING

PICK-UPS
CARTRIDGES
REPLACEMENT STYLLI

SCOPE

SOLDERING IRONS — £2/10/-
TRANSFORMERS — £2/7/11
ETCHING TOOLS — £1/15/-

COUNTRY CLIENTS ARE REQUESTED TO ADD FREIGHT

HOMECRAFT'S *FAST* DESPATCH SERVICE

The cables for connection to the main unit are worthy of some comment. To convey the audio signal a shielded cable of some kind is necessary, and we used a length of coaxial cable known as PT1M. Ordinary shielded cable could be used, but does not do quite as good a job. The shielding braid will also serve to connect the two chassis together, and thus complete the HT circuit.

POWER CABLE

To convey power to the unit, a three-wire cable is used, two wires for the filament circuit and one for the HT positive. These three wires may be plaited, or, as in our case, enclosed in a length of plastic tubing.

Each cable passes through a hole in the rear of the chassis and is firmly anchored to prevent any strain on the connections. In the case of the coaxial cable, the shielding braid is secured to the adjacent earth terminal on the tag strip. This is most easily performed by unravelling the braid for about half an inch from the end of the cable, then twisting it to form a short lead.

This may be passed through the hole in the earth terminal and soldered, anchoring it securely. However, it is necessary to be careful when soldering to either the braid or centre conductor of this cable, since the insulation softens at a low temperature. Do not apply heat for longer than is necessary to make a good joint, make sure that the cable is not bent or twisted, and cool the joint quickly with the aid of a methylated spirit-soaked cloth.

Similar precautions will need to be taken when the centre conductor is soldered to the volume control terminal.

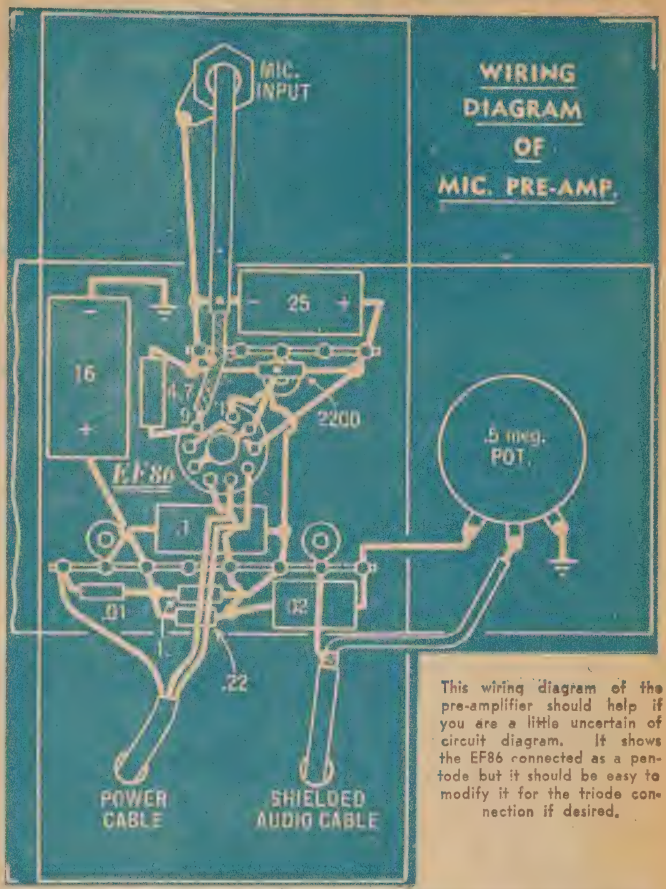
To anchor the power cable we simply bound the end with two or three turns of tinned copper wire, twisted the ends together, and soldered these to a solder lug mounted on the rear of the chassis. The two filament wires may be twisted together and run to the appropriate socket pins, while the HT lead is taken to the end terminal of the tag strip.

FINAL CONNECTIONS

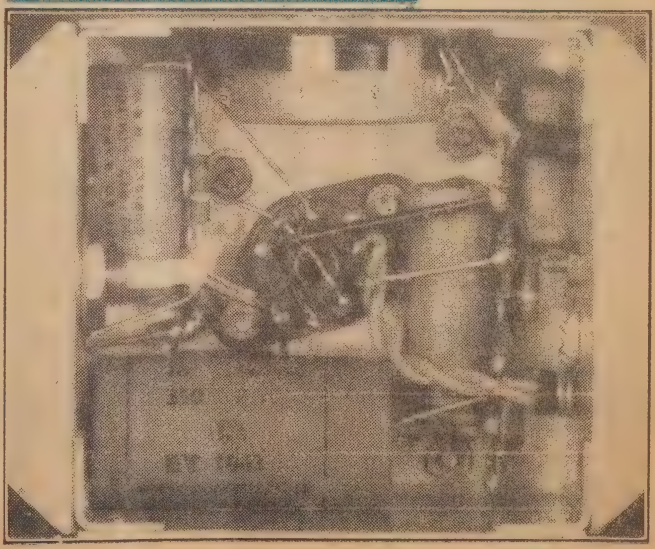
Only a few connections will remain to be made after the pre-assembled units are fitted into the chassis. The short length of shielded wire that runs from the microphone connector to the valve socket grid pin is insulated from the frame of the connector by means of a piece of plastic tubing. This allows the shield to be earthed only at the selected earth point. The 16 mfd electrolytic capacitor is best fitted last.

The next point is to provide power for the unit. This can normally be derived from the main unit and

WIRING DIAGRAM OF PRE-AMP.



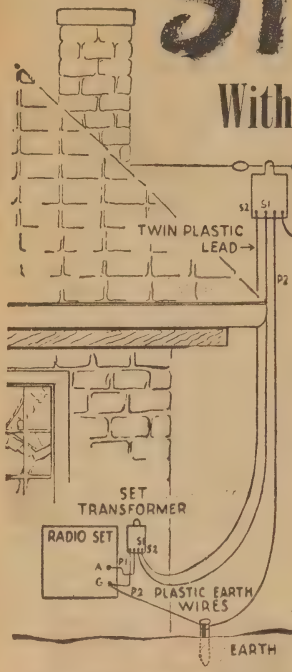
This wiring diagram of the pre-amplifier should help if you are a little uncertain of circuit diagram. It shows the EF86 connected as a pentode but it should be easy to modify it for the triode connection if desired.



An under chassis picture showing the placement of the major components. Left centre is the microphone socket and behind and above it the 25 mfd electrolytic. On the right is the eight terminal tag strip assembly and also the termination to the power and audio cables

STOP NOISE IN YOUR SET

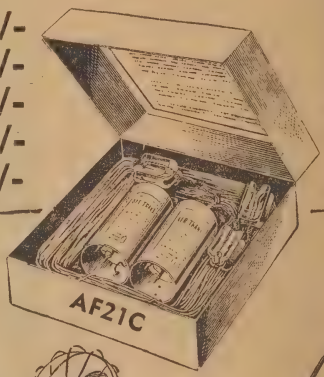
With R.C.S. aerial and line filters



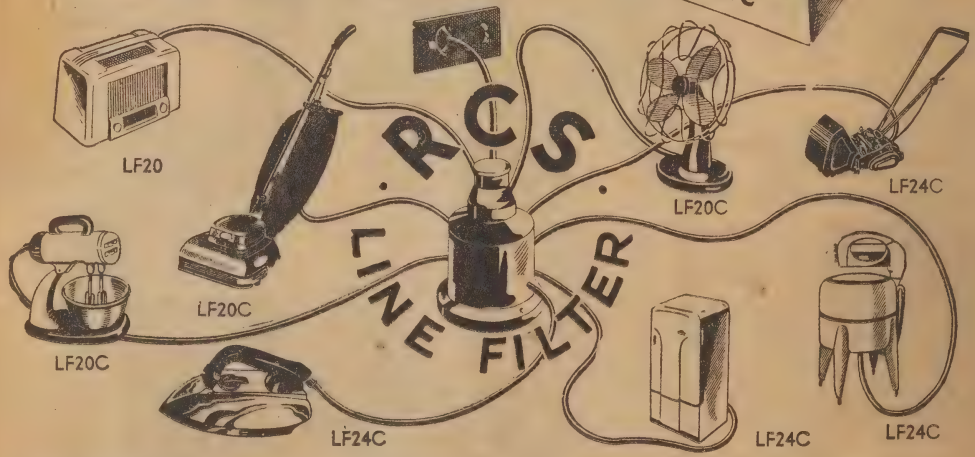
MAKE THIS SIMPLE TEST:—

1. Remove aerial from set. If the noise stops, you need an AF21C aerial filter, as the noise is coming through your aerial.
2. If the noise continues, you need an LF20 line filter as the noise is coming through your power main.
3. If any of the appliances shown below are causing the noise, then fit to it a line filter of the type shown.

Retail AF21C aerial filter		140/-
"	LF20 line filter ..	37/-
"	LF20C " " ...	42/-
"	LF24 " "	50/-
"	LF24C " "	55/-



CONFINE NOISE WHERE IT STARTS — WITH R.C.S. LINE FILTER



DISTRIBUTORS:—

N.S.W. Bloch & Gerber—Fox & MacGillycuddy—U.R.D.—John Martin — Lawrence & Hansom — Homecrafts — Martin de Launay — Radio Despatch — Cooke Bros. —

W.A. Carlyle & Atkins

S.A. Gerard & Goodman.

VIC. R. E. Trickey—Homecrafts—Motor Spares—Radio Parts.

QLD. B. Martin & Irvine—Chandlers.

TAS. Homecrafts — W. G. Genders.

R. C. S. RADIO PTY. LTD.

651 FOREST ROAD, BEXLEY. PHONE LW 3491

COYNES

Technical

books on:

Practical Electricity, Radio & Television

Published by
The Coyne Book Department
of
The Coyne Electrical, Radio & Television School. U.S.A.
Write for lists giving contents of each book to the
Exclusive Representatives for Australia & New Zealand.
ASSOCIATED TRADE JOURNALS CO. PTY. LTD.
N.Z.L. House, 42 Bridge Street, Sydney, N.S.W. BW1400.

ALWAYS RELY ON R.D.S.

R D **Now agents for Eddystone receivers, Erie resistors and Painton plugs and sockets.**

We can supply all Radio and Electrical Components and are agents for the famous Hotpoint Radio Sets. Distributors of Test Equipment, Valve and Circuit Testers, Multimeters, etc.
A Complete Mail Order Service for the Countryman. Call, write or phone to:—

The Independent Wholesaler.

RADIO DESPATCH SERVICE
Radio and Electrical Distributors,
GROUND FLOOR, WEMBLEY HOUSE,
841 GEORGE ST., SYDNEY.
Phone MA1876. Open Saturday Mornings.

AWA RONETTE

MICROPHONES & ACCESSORIES

Type TO-284

£2/12/-

Turnover pickup cartridges for standard and long play. Available in alternative response characteristics as models OV, P, T, TS.

Noyes Bros.
59 GEORGE ST., LAUNCESTON.
and leading wholesalers

Pocket Book Weekly
On Sale All Newsagents

most power supplies will stand the additional drain without distress. In fact, the only drain worth considering is the 200 mA required for the heater, the HT drain being only of the order of 1 mA.

Where the set uses an octal based output valve it is a simple matter to make an adaptor which will plug into the output valve socket and which will provide a new socket for the output valve. Leads running from the filament and screen will provide power for the unit.

An adaptor can easily be made from a moulded socket and an old valve base, the two being selected with regard to their respective sizes in order that they may fit together snugly. Bare tinned copper wire of about 20 gauge will serve to connect the two sections together, and the leads to the pre-amplifier can be taken through a hole in the side of the valve base.

ALTERNATIVE ARRANGEMENT

Where miniature valves are used this arrangement is hardly feasible, mainly because there is no ready source of bases to make an adaptor. An alternative arrangement is to fit terminals or an outlet socket to the chassis. The outlet socket is probably the better scheme, if only because it does not leave an exposed terminal carrying HT. A miniature four-pin speaker socket would be a logical choice, and there should be room on most chassis to accommodate it.

Although we have specified the EF86 valve, there is no reason why a 6BR7 could not be used in a similar circuit. The gain will be a little less, but it should still be more than sufficient in all but extreme cases.

If it is to be operated as a pentode the component values would be as follows: Plate load resistor, .22 meg. Screen resistor, 1.5 meg. Cathode bias resistor, 1500 ohms.

For triode operation a plate load resistor of .22 meg and a cathode bias resistor of 14,000 ohms would be correct.

When you finally set the equipment up for test don't be surprised if the whole thing screams its head off as soon as you advance the volume control. This will be due to acoustic feedback, caused in turn by the microphone picking up signals from the speaker and feeding them back into the system.

MICROPHONE PLACEMENT

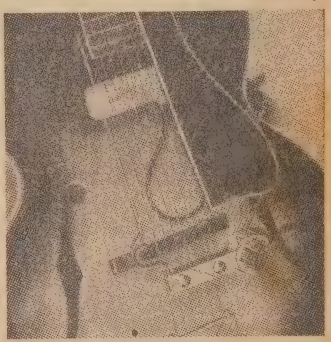
This is quite normal, and you will have to place the microphone as far away from the speaker as possible. In order to turn the system up for testing it would be best to locate them in separate rooms.

The tendency to feedback will be aggravated by any peak in the system, since the system will spill over at this frequency before a useful level is reached at other frequencies. Many cheaper crystal microphones have a tendency to peak badly, and these types should be avoided if possible.

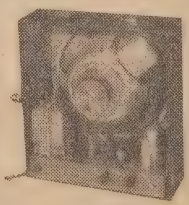
Where such peaks are present, due to the microphone or any other cause, it is sometimes possible to minimise their effect by limiting the top response of the system with the conventional tone control. Naturally, there is a limit to the amount of top cut which can be tolerated, but it is often possible to select a degree which is a suitable compromise between feedback and top response.

ELECTRIC GUITARS ... MIKES and ... AMPLIFIERS

Electric Hawaiian Guitar, complete in case—a masterpiece of workmanship and an outstanding instrument. Volume is adjustable for a large hall or a small room. Price **£29/17/6**



Microphone suitable for any professional type guitar, comes complete with volume control attached and needs no screws or holes to hold it. Fitted in a few moments. Flick of the knob turns guitar from acoustic to electronic. Price **£12/10/-**



Amplifier in case.
10 Watt .. **£49**
5 Watt .. **£30**
10 Watt push pull (2) 6AQ5, (1) 12AU7, (1) 6AU6, (1) 5Y3G. L Millivolt sensitivity for full output. With volume and tone controls. De luxe 12in speaker and case. 5 Watt model (1) 6AQ5, (2) 6AU6, (1) 6X4. 12in speaker and cabinet.

R. H. OXFORD & SON PTY. LTD.
97 MARRIOTT ST., REDFERN, NSW —— Phone MX3764

A.C.E. RADIO

Amplification Communication Electronics

PHONE LA 3845

136 VICTORIA RD. MARRICKVILLE, SYDNEY, N.S.W

EVENINGS and WEEKENDS: "KALUA", COLLAROY ST., COLLAROY—XW 5956
DULWICH HILL, UNDERCLIFFE, EARLWOOD, TRAM AT DOOR. STOP No. 42

New Telephone Wire

American 7 Strand Rubber insulated
½ MILE DRUMS £1/15/-
CASE OF 6 DRUMS, 3 MILE £10/-/-

RESISTORS

New: famous maker
100 ASSORTED—over 30 values
50 1 watt, 25 ½ watt, 25 ¼ watt
12/6

240v 50 cycle TRANSFORMERS

1500 x 1500V 750ma .. £10/10/-
750 x 750ma £7/10/-
500 x 500V 250ma £5/-/-
400 x 400 150ma £2/5/-
290 x 290 250ma £2/5/-
2.5—CT—2.5V 15 amp .. £1/-/-
5—CT—5V 10 amp £1/-/-
10—CT—10V 10 amp .. . £1/-/-
650ma Chokes £3/10/-
400ma Chokes £2/10/-
150ma Chokes £1/2/6
240/110 AUTO TRANSFORMER
2.5kw £8/10/-

COLLARO MOTORS
For that Tape Deck
£2/12/6

AT5/AR8 STATIONS

24 volts — Complete with all accessories, including one crystal to required frequency.
OVERHAULED AND AIR TESTED
£62/10/-

AR7 RECEIVERS

OVERHAULED AND IN FIRST CLASS ORDER
£47/10/-

THOMPSON PUMPS

400 GALLS PER HOUR STAINLESS STEEL VANES
New £2/17/6

NEW CIRCULAR TWIN FLEX

Rubber insulated and braided. 50 YDS.
250 volt AC grade .. £1/5/-

NEW CONDENSERS ELECTROS

4mfd 350v, 10mfd 40v, 400mfd 12v
12/6 doz.

TUBULAR CONDENSERS

.25, .1, .02, .008 600v 9/- doz.
.5, .25, .1 400v 7/6 doz.
.5, .25, .1 200v 6/- doz.

RAX. RECEIVERS

8 VALVES

4 BANDS 1.5 to 9 megs.

New condition. Simple conversion by addition of Power Supply and Speaker. Ideal for small ships, fire brigades and amateurs, &c.

£21/0/0

5 BANDS 7 to 27 megs.

£25/0/0

Extra charge to convert and air test including speaker and power supply:—
24 or 32V DC £6/10/-
12V DC £12/10/-
240V AC £10/10/-
Postage extra

NEW INVERTERS
6v or 12v DC to 240 AC

Operate mantel or other set from DC. For caravans, boats etc. 6v 40 watt. 12v 60 watt.
£7/17/6

WANTED

Communication Receivers. Test equipment. P. A. gear Large or small surplus stock. Best prices. Call, write or phone any time.

V.H.F. Receiver Type 733

6 Locked Xtal Channels, 108-120 Mcs. 10 Valves.
Small • Sensitive • Efficient • with Photostat of Circuit.
£9/17/6

Will convert to vehicle band. State frequencies and voltage required. Prices on Application.

NEW A.R.R.2 RECEIVERS

A VHF receiver, 230 to 258 Megs, and 6 channels on broadcast band. Ideal conversion to carset and for hams. A ready-made, double conversion VHF receiver 10 miniature valves, smaller than average carset. Including photostat of circuit. PRICE £11/17/6
REMOTE CONTROL UNITS 7/6

ZB2/A.R.R.1. RECEIVER

Similar to HF section of ARR2 4 acorn valves. £3/17/6

COMMAND EQUIPMENT

TX 4—5.3 mcs complete with xtal
5.3—7.0 mcs and valves
RX 6— 9 mcs £6/17/6

TX 4—5.3 mcs less valves and xtal
5.3—7.0 mcs
7.0—9.1 mcs £3/-/-

Modulator with valves, £2/12/6. Less valves, 25/-.

BENDIX

BC221 FREQUENCY METERS, AIR TESTED
Original Crystal and Calibration Book
£45/-/-

LM10. Same unit in smaller case and modulation
£37/10/-

GIBSON GIRL TRANSMITTERS

Automatic or keyed hand generators
£2/17/6

DIODE VOLTMETERS

EA50, 100UA Meter, Ceramic Switch, Metal Carrying Case.

Reads 100V and 500V from 75 Co-ax Line, but can readily be altered to suit individual requirements.

With Circuit £3/17/6

A.C.E. RADIO

Amplification Communication Electronics

PHONE: LA 3845

136 VICTORIA RD. MARRICKVILLE, SYDNEY, N.S.W

DULWICH HILL, UNDERCLIFFE. EARLWOOD TRAM AT DOOR. STOP No. 42

EVENINGS and WEEKENDS: "KALUA", COLLAROY ST., COLLAROY—XW 5956

Microgroove Adaptors
Chancery units which will convert any 78 rpm player unit to 33 rpm.
17/6
with Hi-quality Pick-up
£3/17/6

NEW POTENTIOMETERS
10K, 25K, 100K Carbon **2/6** ea
1Meg .. .. **3/6** ea.
1 meg D.P. Switchpots **5/9** ea.
5K, 10K W/W .. .. **4/6** ea.
3 gang 7K,7K,200 ohms **5/6** ea.

New Valves

OZ4	15/-	12SK7	12/6
1C6	12/6	12SL7	12/6
1D4	12/6	12SN7	12/6
1D5GP	12/6	12SR7	12/6
1G4	12/6	38	12/6
1J6	12/6	39/44	10/-
1K4	12/6	46	12/6
1K5	3/6	47	12/6
1K6	12/6	57	12/6
1LH4	12/6	58	12/6
1LN5	12/6	78	12/6
1P5	12/6	304H	£5
1R4	12/6	717A	12/6
1V	12/6	807	£1
2A6	12/6	809	£2
3A4	15/-	843	30/-
3B7	10/-	866A	£1
3D6	10/-	957	10/-
6AC7	12/6	1619	£1
6AG5	12/6	1625	£1
6AG7	15/-	1629	10/-
6AM5	15/-	2050	£1
6AM6	17/6	4307A	10/-
6C4	12/6	9001	10/-
6H6	7/6	9003	12/6
6J6	15/-	9004	10/-
6J7G	12/6	AF3	12/6
6N7	10/-	AZ1	10/-
6SA7	12/6	ECH3	12/6
6SH7	7/6	EK2	12/6
6SK7	12/6	RK75	10/-
6SL7	12/6	RK78A	£3
6SN7	12/6	VR65A	3/6
6SQ7	12/6	VR75/30	15/-
6Y6	17/6	VR105/30	15/-
10	15/-	VR150/30	15/-
12A6	12/6	NR74	7/6
12H6	7/6	ATP35	12/6
12SJ7	12/6		

NEW V.H.F. WAVEMETERS
3 Valves, O-1 M.A. meter
Slow motion dial
INCLUDING CIRCUIT **£6/17/6**
160-220 M.C.S. readily converted to 144 M.C.S.

TUNING HEADS
Hi-quality Dial Movement
40:1 Gear Ratio
Anti-Backlash
with ARB Calibrations
or 0-100
NEW £1/-/-

New Coils & Intermediates Standard or miniature to suit all valves.
Coils B/C 455 KC **7/6**
Coils S/W 455 KC **7/6**
Inters **9/6**
Loop aerial coils **7/6**
Slug tuned H.F. Coils suit 144 Mls **4/6**

WIRE WOUND RESISTORS
80 Watts 5000 ohms .. **12/6**
40 Watts 6000, 850, 50 ohms .. .. .. **2/6** ea.
20 Watts 10 K, 50 36, 25 ohms .. .. **2/6** ea.
I.R.C. 1% Wirewound
20 K, 30K, .15m .2m, .25m, .5m, 1.0m, **7/6** ea.

NEW C.R.O. VALVES
VCR 97. 47/6
VCR 13.8 42/6
Specially suitable for TV experiments.
Socket connections supplied.

OIL FILLED CONDENSERS

.1UF 2.5KV	25/-	4UF 1KV	12/6
.5UF 6KV	17/6	4UF 600V	6/6
5UF 2.5KV	6/6	5UF 400V	6/6
.1, .1UF 7KV	15/-	8UF 400V	10/-
8UF 750V	15/-	7.5UF 330VAC	10/-

RELAYS
500 x 500 ohm 12/6
12 volt DPDT 5 amp .. £1/-/-
24 volt DPDT 12/6
8-16 volt DPDT 12/6
110 volt AC £1/-/-
Aerial change over. Shielded 18/6
AWA 12 volt £1/-/-
Hi-Speed Polarised relay £2/10/-
400 ohm 12/6
1300 ohm DPDT 15/-

Co-ax. Twin Cable, 20ft lengths 8/-
Mike Transformers 4/6
Throat Mikes, new 3/6
12v 420 watt Prefocus Globes 7/6
101 or FS6 7-pin Plugs & Cables 7/6
Butterfly Condensers 60 x 60 7/6
12v 50 amp Contacters .. . 10/-
AWA 6v Gasfilled Vibrators 15/-
Octal Sockets .. .. .. Doz. 5/-
Hydrometers. Battery testers 5/9
Torches, 3-cell Focusing .. . 9/9
Torches, 2-cell Focusing .. . 6/9
Multi-strand 5 and 7-core Cable. Yard, 1/-, 100 yards . £2/17/6
Ceramic Formers 2in diam. .. 5/-
Tx. Var. Condensers. 300 pf £1/5/-
100 pf £1/1/-
60 pf with Vernier £1/1/-
30 pf 10/-
Tx. Mica Fixed Cond. 100 pf 3/6
600 pf 3/6
Hi-Lo Phone Transformers .. 4/6
Spirit level bubbles, mounted 4/6
Canadian Signal Lamps .. 12/6
24v 1500 watt Generators £12/10/-
Dry Rectifiers 6/12v 3A . £2/5/-
Hi-Voltage Lead-Thru Insulators, 1/6 each, 15/- doz.
Lifeboat Transmitters .. £1/7/6
Slydlok Fuseholders — 5A, 15A, 60A, ... 1/6, 2/6, 5/- ea.
Variable Inductances, Ceramic Formers, 2-19mcs £1/-/-
Variable Inductances, Bakelite Formers, Vega Counter .. 12/6
Variometers, suit B/C Band 7/6
P.A. Output Transformer 6600 ohms C.T. to 500 ohms & V.C. 20 watts £1/15/-
Line Transformer 600 ohms to Universal V.C. 27/6
Heavy Duty H.V. Switch, Ceramic 8 Position—2 Bank 12/6
4 Bank £1/-/-
Morse Keys, Insulated 5/6
Jack Plugs—Standard 3/6
U.S. 3 Contact 4/6
Eng. 4 Contact with socket .. .. 5/- pr.

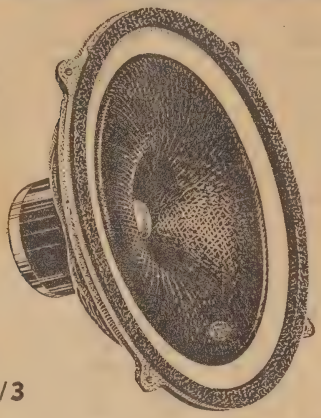
GENEMOTORS
6v-550v 160mA £6/10/-
12v-550v 350ma £6/10/-
12v-270 100ma £3/15/-

EVERYTHING for the Radio Hobbyist . . .

THE WARBURTON FRANKI PAGE

—Check it each month

Fully Tropicalised against Dust, Rust and Dampness!



THIS NEW "DE-LUXE"

12" BAKER SPEAKER

With Cloth Suspended **EXPONENTIAL CONE**

is the Greatest Achievement To Date

in this class of Moving-Coil-Speaker Manufacture.

This speaker gives a phenomenally realistic reproduction credible only to those actually listening to its performance. Cone housing of thick, sturdy aluminium casting completely free from undesirable resonances and magnetic leakage. Wonderfully even response over the entire musical scale. No Bass "Boom" whatsoever!

Price £25/16/3

SPECIFICATIONS

SUSPENSION .. .. CLOTH
EFFECTIVE CONE DIAMETER .. .. 9¼ INS.
VOICE COIL IMPEDANCE (TO ORDER) .. STANDARD 15 OHMS.
FUNDAMENTAL RESONANCE .. .. (APPROX.) 35 C.P.S.
FREQUENCY RANGE .. .. 18/17,000 C.P.S.
FLUX DENSITY .. .. (APPROX.) 15,000 LINES PER SQ. CM.
MAXIMUM PEAK A.C. INPUT (OPEN BAFFLE) .. .. 15 WATTS.
VOICE COIL DIAMETER .. .. 1½ INS

MICROPHONES

Choose from W.F.'s Extensive Range of all Types . . . FAMOUS ITALIAN GELOSO MICROPHONES (illustrated below)

Cat. 400 "Ball" type Crystal microphone, £5/19/11.

Cat. 1100/V; Swivel cage crystal type with volume control, £8/1/6.

Cat. 416: Double ribbon microphone with line transformer and switch, £15/15/-.

NEW "MODERNE" RECORD PLAYER CABINETS

Latest streamlined design in two-tone leatherette with contrasting piping.

Small Type for Garrard "S" Units etc. 115/-

For Standard Player Units 125/9

For Velvet - Action Record Changers 150/11

● ● ● ●

REPLACEMENT NEEDLES for ACOS GP20 & HGP40

Standard or Microgroove — 14/3 fitted

SAME DAY SERVICE Available also for CHANCERY, RONETTE, DECCA, COLLARO, SHURE, ASTATIC, PLESSEY, B.S.R., ACOS, GP29, HGP33 & HGP37 HEADS.

● ● ● ●

Write for illustrated pamphlets on all Zephyr and Geloso Microphones and Equipment.

WARBURTON FRANKI (MELB.) LTD.

380 BOURKE ST., MELBOURNE, C.1... PHONE: MU6355

Open Saturday Mornings

●

Trade Supplied

●

. . . POSTAGE OR FREIGHT MUST BE INCLUDED WITH ALL ORDERS . . .

TRACKING OF RF OSCILLATORS

The subject of oscillator tracking in a superhet receiver is one which frequently puzzles our readers. This article by Aerovox Engineers explains why tracking is necessary and how it is achieved with the aid of a "padder" capacitor.

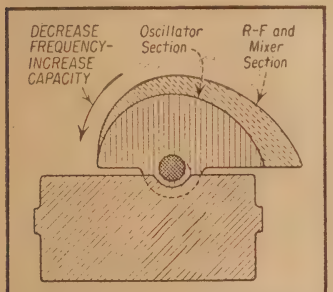
ONE of the most important problems connected with local oscillators in gang-tuned radio receivers is tracking.

Lower-priced AM broadcast receivers occasionally dispense with variable oscillator padders because tolerances of tracking and dial accuracy are relatively large. On the other hand, the better AM broadcast receivers, all-wave receivers, and especially communications receivers, are designed rather carefully for good tracking.

Even in a receiver in which the oscillator padder is not variable, the fixed padder capacitor value should be carefully calculated.

OSCILLATOR FREQUENCY

The local oscillator frequency should tune so as to be separated always from the resonant frequency of the RF tuned circuits by an amount equal to the intermediate frequency. This means that the oscillator tuning range in kilocycles or megacycles must be exactly equal to the tuning range of the RF tuned circuit.



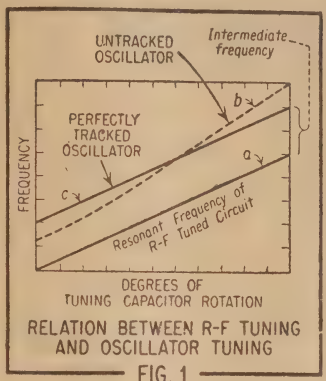
HOW OSCILLATOR CAPACITOR PLATE MAY BE SHAPED FOR TRACKING

FIG. 2

Suppose the RF circuit and the oscillator circuit are both tuned by identical sections of a gang capacitor, and the oscillator coil inductance made smaller accordingly. The oscillator frequency cannot be kept equally spaced from the resonant frequency of the RF section without special tracking measures. Instead, the oscillator frequency varies as indicated by curve "b" of Fig. 1, where curve "a" is that of the RF tuned circuit.

Note that the actual heterodyne signal frequency changes from a relatively small difference frequency at the low end of the range to a relatively high difference frequency at the high end.

The purpose of tracking circuits is to make the oscillator frequency variation such that the RF-oscillator frequency difference approaches a constant value equal to the intermediate frequency, as illustrated by curve "c".



RELATION BETWEEN R-F TUNING AND OSCILLATOR TUNING

FIG. 1

One simple way of providing tracking is by use of a smaller gang capacitor section for the oscillator, and "shaping" the rotor plates of the section. This shaping changes the capacitance vs. rotation relation of the oscillator section of the capacitor so that it compensates for the deviation of curve "b" from the desired curve "c".

A typical shaped plate appearance is illustrated by Fig. 2. This method of tracking is widely used in lower-priced American AM broadcast receivers.

It has two limitations:

1. It cannot be used in receivers providing more than one frequency band, because the plate shaping is good for only one range, and

2. It provides no alignment adjustment for future correction for changes in circuit constants due to temperature, humidity, dust, ageing, &c.

TWO CAPACITORS

Because of these limitations, the best available tracking method is considered to be that in which two adjustable capacitors are added to the oscillator circuit, as illustrated in Fig. 3.

One is connected across the variable tuning capacitor (Ct) and is called a "shunt trimmer" or sometimes just a "trimmer". The other is connected in series with one of the leads between the variable tuning capacitor and the oscillator coil (Cp) and is called a "series padder" or just "padder".

At the high frequency end of the tuning range, the tuning capacitor C is at its minimum value, and the shunt trimmer has the higher capacitance of the two.

Accordingly the shunt trimmer has a marked effect on the oscillator tuning curve at and near the high frequency end of the range, but negligible effect toward the low frequency end, where the tuning capacitor value becomes very large in comparison.

On the other hand, the series padder has an important effect at and near the low frequency end of the tuning range and negligible effect toward the high frequency end.

This follows from the basic fact that when two capacitors are connected in series, variation of one capacitor has its greatest effect on the combined series capacitance when the other capacitor is at its maximum value.

Thus, when the oscillator tuning inductance is properly chosen, the shunt trimmer corrects the high frequency portion of the tuning curve, and the series padder corrects the low frequency portion.

If close tracking is required, both of these adjustments are necessary to overcome production tolerances in inductance, distributed capacitance and stray capacitance.

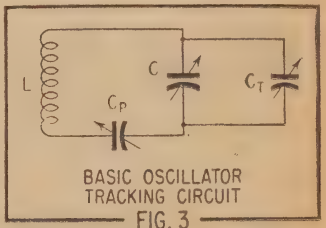
In order to ensure good tracking, the designer must compute the proper values of L, Ct and Cp to make the oscillator tuning approach perfect relation to the RF tuning curve.

TRACKING ERROR

To do this, expressions can be set up for the resonant frequency of the combination of the three components in the tuned circuit, plus the tuning capacitor section for each point at which oscillator tracking error is to be zero.

Absolute zero tracking error is not possible over the entire tuning range. However, the maximum error anywhere can be kept small by calculating circuit constants to give zero error at one or more frequencies. If these frequencies have been properly chosen, the remainder of the tuning curve will be very close to that desired.

The quality of a tracking circuit can be expressed by plotting the oscillator frequency error against frequencies in the RF tuning range of the



BASIC OSCILLATOR TRACKING CIRCUIT

FIG. 3

receiver, as shown in Fig. 4. Positive errors (oscillator frequency too high) are plotted above the line, negative errors (oscillator frequency too low) below the line.

The graph of Fig. 4 shows approximately the error variation resulting from the untracked curve of Fig. 1, curve "b".

It can be shown that, as L, Ct and Cp approach their proper values, the error curve takes the approximate form shown in Fig. 5. Because of the

ELECTRONIC

AR EQUIPMENT

New Range of AUDIO TRANSFORMERS

19 TYPES!

MEDIUM FIDELITY
+ — 9db 50-12000 cps.

OUT-PUT TYPE

TYPE 809 — 15 watts.
Prim: 500 ohms.
Sec.: 15, 12.5, 8, 3.7 and 2 ohms.

TYPE 914 — 15 watts.
Prim: 5000, 3000 ohms P.P.
Sec.: 500, 250, 166, 125 and 100 ohms.

TYPE 915 — 15 watts.
Prim: 5000, 3000 ohms P.P.
Sec.: 15, 12.5, 8, 3.7 and 2 ohms.

TYPE 917 — 15 watts.
Prim: 10000—8000 ohms P.P.
Sec.: 500, 250, 166, 125 and 100 ohms.

TYPE 918 — 15 watts.
Prim: 10000, 8000 ohms P.P.
Sec.: 15, 12.5, 8, 3.7 and 2 ohms.

TYPE 922 — 25 watts.
Prim: 8000 ohms P. P.
Sec.: 500, 250, 166, 125 and 100 ohms.

TYPE 891 — 35 watts.
Prim: 6600 ohms P.P.
Sec.: 500, 250, 166, 125, 100 and 83 ohms.

TYPE 892 — 55 watts.
Prim: 3200 ohms P.P.
Sec.: 500, 250, 166, 125, 83, 62 and 50 ohms.

DRIVER TYPE

TYPE 588 — 5 watts.
Prim: 5000 ohms S.E. or P.P.
Sec.: 7100 ohms per side response: 200-7000 cps.

TYPE 545 — 10 watts.
Prim: 4000 ohms S.E.
Prim: to ½ sec. ratio 1.6
1 response: 50-16,000 cps.

Modulation Type

TYPE M175 — 7.3 — 75 watts.
Response: 200-7000 cps.
Prim & Sec.: Multi- impedance.
Ceramic terminals fitted with spark gap and closed steel case.

HIGH-FIDELITY
1db 30-15,000 cps

OUTPUT TYPE

TYPE 763 — 15 watts.
Prim: 5000, 3000 ohms. P.P.
Sec.: 15, 12.5, 8, 3.7, and 2 ohms.

TYPE 920 — 15 watts.
Prim: 5000, 3000 ohms. P.P.
Sec.: 500, 250, 166, 125, and 100 ohms.

TYPE 896 — 15 watts.
Prim: 10000, 8000 ohms P.P.
Sec.: 15, 12.5, 8, 3.7, and 2 ohms.

TYPE 897 — 15 watts.
Prim: 10000, 8000 ohms P.P.
Sec.: 500, 250, 166, 125, and 100 ohms.

SPECIAL HI-FIDELITY
+ — 1 db 20-40000 cps.

OUTPUT TYPE

TYPE 870 — 6 watts.
Prim: 10000 ohms P.P.
Sec.: 2 or 8 ohms (for "Rola" 120X)

TYPE 871 — 12 watts.
Prim: 10000 ohms P.P.
Sec.: 2 or 8 ohms.

TYPE 872 — 12 watts.
Prim: 10000 ohms P.P.
Sec.: 3.7 or 15 ohms.

ULTRA-LINEAR OUTPUT TYPE

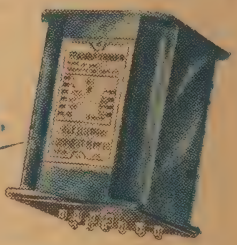
★TYPE 916 — 12 watts.
Prim: 8500 ohms P.P. (with screen taps)
Sec.: 916-8: 2 or 8 ohms.
916-15: 3.7 or 15 ohms.

★FULL POWER AND RESPONSE ALL IMPEDANCES!

Manufactured by

A & R ELECTRONIC EQUIPMENT CO. PTY. LTD.
378 ST. KILDA RD., MELBOURNE, VIC.
★ Full details of the complete range available from our distributors.

all in a New colour...

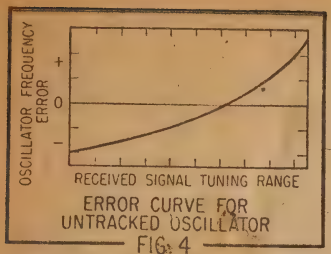


A & R TRANSFORMERS

NOW SOLD EXCLUSIVELY by these distributors:—

MELB. & VIC.	STH. AUST.	QUEENSLAND	WEST AUST.	TASMANIA	N.S.W.
Homecrafts Pty. Ltd., J. H. Magrath & Co., Pty. Ltd. Radio Parts P/L, Warburton Franki Ltd.	Gerard & Goodman Ltd., 196 Rundle St., Adelaide.	A. E. Harrold, 123 Charlotte St., Brisbane.	A. J. Wyle Pty. Ltd., 1011 Hay St., Perth	Homecrafts Pty. Ltd., 220 Elizabeth St., Hobart.	United Radio Distributors Pty. Ltd., 175 Philip St., Sydney Homecrafts Pty. Ltd., 100 Clarence St., Syd.

LOOK FOR THE SILVER-GREY TRANSFORMER



ERROR CURVE FOR UNTRACKED OSCILLATOR

FIG. 4

three variables, the curve equation is a cubic, and crosses the zero axis in three places. These three places are the frequencies of zero error.

The proper locations of these frequencies can be determined by making certain assumptions. First, it is assumed that tracking is nearest perfect when the maximum error is the same at all four maximum points; in other words, when the curve is symmetrical.

By substituting boundary conditions in the general cubic equation, one derives the fact that the zero-error frequencies should be:

$$f_1 = f_c - (f_c - f_a)$$

$$f_2 = f_c$$

$$f_3 = f_c + (f_c - f_a)$$

Where

f_1, f_2 and f_3 are the zero-error tracking frequencies

f_c is the center frequency of the r-f tuning range

f_a is the frequency at the low edge of the r-f tuning range

For the standard AM broadcast band of 550-1600 kc, these frequencies come out to be f1-620.35 kc, f2-1075 kc, and f3-1529.65 kc.

Of course, individual manufacturers may have other considerations which have led to the use of different tracking frequencies; 600 kc and 1400 kc are widely used for the low and high points.

GENERAL EXPRESSION

These latter points (f1 and f2) are the ones at which the padder and trimmer capacitors, respectively, are adjusted. The centre point should then fall automatically into place, providing the inductance is correct.

In the derivation of design expressions for the values of the shunt and series padder and the oscillator coil inductance, a general expression for the resonant frequency of the oscillator tank including the padder and trimmer plus tuning capacitor is set up.

This general expression is then modified to form three expressions, one for each tracking frequency. These are in terms of the RF tuning capacitor value (usually the same as the oscillator capacitor), and RF tuning capacitor inductance. Solution of these three expressions simultaneously results in equations for the trimmer, padder and inductance.

These mathematical operations and the resulting expressions for the trimmer and padder capacitance and inductance are quite cumbersome, so will not be repeated here. However, several approaches will be found in the literature (1, 2, 3).

The previously-described treatment is one of several similar approaches to the problem. As mentioned above, other positions may be assumed for the end tracking frequencies, so they are within the tuning range instead of at its edges.

Thus, it is common practice to use 600 kc and 1400kc as low and high frequency alignment points, respectively, for the 550-1600 kc AM broadcast band.

The design may also call for the centre "zero-error" point to fall at the geometric mean (895 kc for the above range), instead of at the arithmetic mean frequency.

"CUT AND TRY"

In practice, there must always be a certain amount of "cut-and-dry" adjustment of design values, after the latter have been theoretically determined. This is necessary because of modifying factors such as mutual inductance.

One of the assumptions of most analyses of tracking is that both the signal and oscillator tuned circuits are isolated from the rest of the wiring and that the tuned coil and connected capacitance are the sole factors determining resonant frequency. Without this assumption, the mathematical expressions would become overly cumbersome.

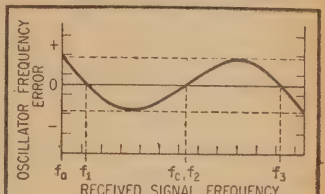
Obviously signal and oscillator coils would be of no use if not coupled to anything. The practical approach is to minimise the reactive components due to such external coupling, so the calculated tracking values still have practical meaning.

In the signal circuits, for example, this would seem to favor the use of inductive coupling over capacitive coupling. It would also encourage the use of electrostatic shield between primary and secondary winding of each tuned RF oscillator.

By the same token, the oscillator would preferably be inductively coupled to the mixer, when separate tubes are employed, and such coupling would be as loose as possible.

In pentagrid converters, a certain amount of space-charge capacitance coupling is of course inevitable.

When the oscillator is of the inductive feedback type, serious modification of the tracking design can result if the "tickler" coil has too much inductance. Tight coupling with low inductance is best, so that the self-resonant frequency of the tickler coil is well above the tuning range limits. If the coupled reactance is too large, it also limits the



THREE-POINT TRACKING ERROR CURVE

FIG. 5

tuning range and is an important factor when the latter is required to be relatively large.

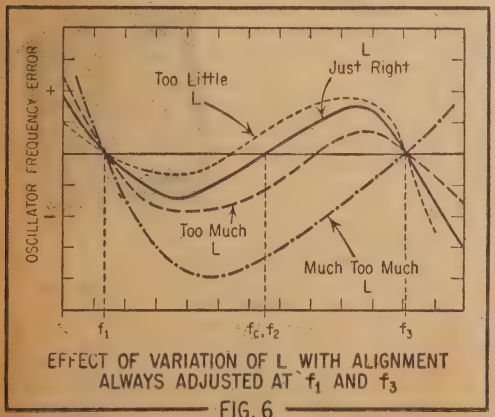
3-POINT TRACKING

In the idealised three-point tracking arrangement of fig. 5 it is assumed that, although the series and shunt capacitance is adjustable during alignment, the inductance is fixed. This is true in a good many cases.

Thus, in practical design, the engineer must anticipate what tolerance in fixed inductance value can be allowed consistent with permissible maximum tracking error.

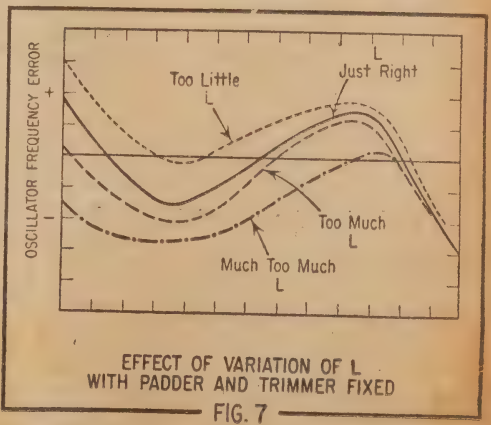
Figure 6 shows the effect on three-point tracking of changes in induc-

(Continued on Page 95)



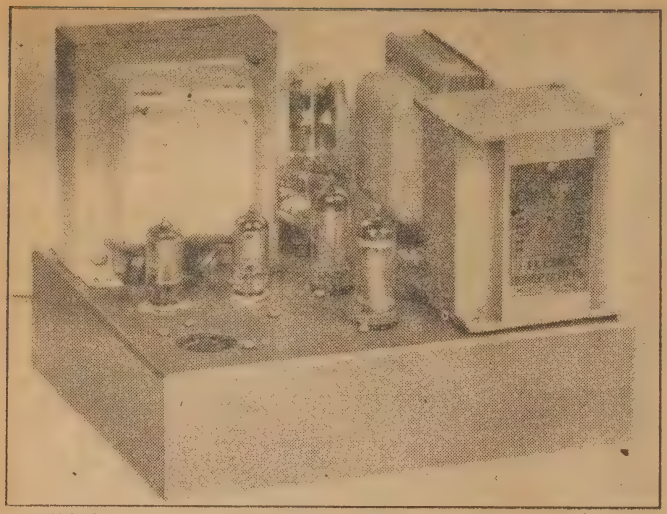
EFFECT OF VARIATION OF L WITH ALIGNMENT ALWAYS ADJUSTED AT f_1 AND f_3

FIG. 6



EFFECT OF VARIATION OF L WITH PADDER AND TRIMMER FIXED

FIG. 7



The amplifier used for many of the tests detailed in this article was a standard type using 6BW6 valves which are similar to the 6V6 type. The output transformer is one of those used during the tests.

ULTRA-LINEAR EXPERIMENTS

This article relates some initial tests on ultra-linear amplifiers and tabulates the results obtained from them. These support the view that the circuit is capable of greatly improving the performance of pentodes or beam power valves in push-pull amplifiers and suggest that adequate output can be obtained from standard valves using moderate operating voltages. At the same time it is apparent that the circuit merits still further analysis in some respects.

THE design of the power output stage is probably the most important single task in producing a high-grade amplifier.

It is the generator of power from which the loudspeaker is driven. In deciding on a suitable circuit and suitable valves, we are concerned with numerous factors relating to the generation of power without distortion, and its efficient coupling into a load.

How this may best be done isn't a simple matter.

COST FACTOR

In the first place it is related to the cost of the components we are permitted to use, and the complexity which we are able to control in the circuit itself. When considering amplifiers, which people can buy at a reasonable price, or which they can build up without running into trouble, both these things are very important. In fact, the economics of the subject play a most significant part in modern amplifier design, and it is therefore essential to form the clearest possible assessment of the performance standard which can be considered satisfactory.

This is something which is easier said than done. There are few subjects upon which so many different ideas have been published and for which there have been so many different answers.

The issue has been to some extent submerged beneath the undeniable fact that the performance of loudspeakers and phonograph pickups is on the whole much inferior to that of a good amplifier built to one of several standard designs. While this is no excuse for not building the best practicable amplifier, it does have a profound effect on deciding how good it needs to be to sound well.

Of recent years, the ear has not been considered a very reliable instrument of measurement when judging amplifiers. This is the natural result of improvements in testing methods and equipment, which have taught us a great deal about what goes on in the power stage.

But, as a means of checking the final results, the ear cannot be ignored. It can detect amplifier characteristics even if it cannot measure them, and its information is most important in evaluating the data provided by our methods of testing.

In considering valves for use in the output stage, the classic discussion continues to centre around the use of triodes as against pentodes, a general term we will use to cover the beam power valves almost universally employed today.

There is really no conclusion to be drawn from such a discussion unless the purpose for which the amplifier is used is first stated clearly. Where cost and complexity are not objects, then the triodes appear to offer most advantages; but if we are interested in balancing the best possible results against efficiency and cost, the pentodes cannot be ignored.

Triodes have a lower efficiency than pentodes, requiring high plate voltages and currents to give amounts of output which are provided by pentodes with a much lower power consumption. In push-pull circuits, which are used almost exclusively in high-grade amplifiers, triodes have more favorable distortion figures, particularly in the odd harmonics which are the source of much objectionable sound. They have also a much lower effective output impedance, which reflects a lower load to the loudspeaker and is more effective in damping out resonances.

By using adequate inverse feedback with a pentode amplifier, both distortion and speaker damping are greatly improved, and can be made to approximate those of triodes. On the other hand, inverse feedback with triodes improves their performance also, and although the gap between the performance of the two types is lessened, the triodes still show better figures.

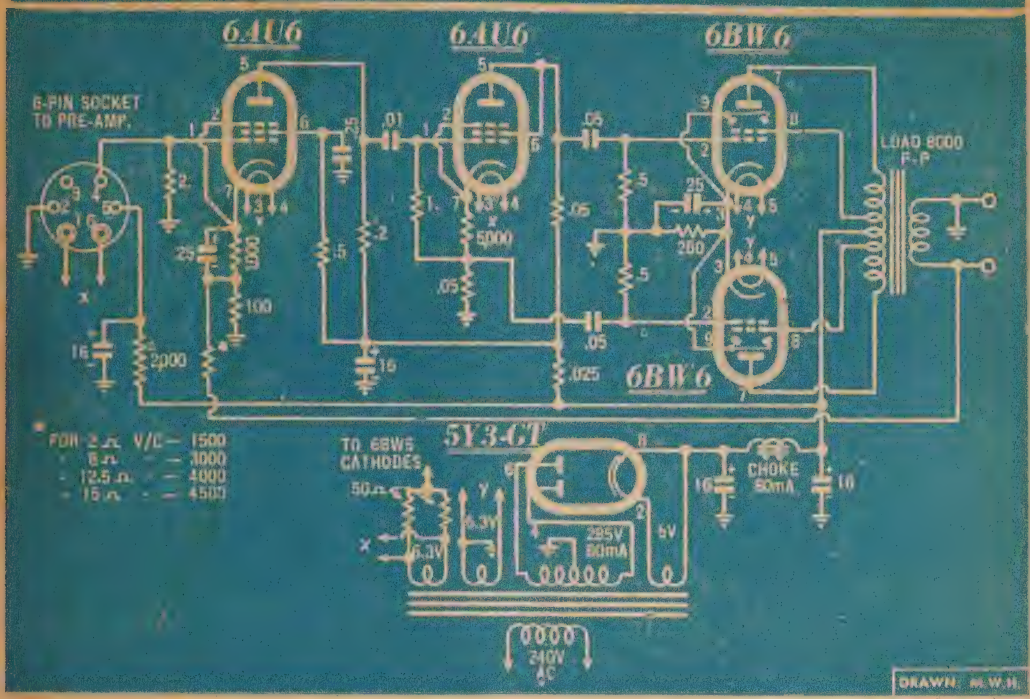
EFFECT OF FEEDBACK

At the same time, the power output available from an amplifier with feedback does not decrease, so that this advantage over triodes is maintained. Feedback reduces the overall sensitivity of the amplifier, but this reduction is the same for both types of valves using the same amount of feedback.

In the more recent past we have been inclined to advise the use of pentode valves with feedback as being the best solution for a good,

by John Moyle

CIRCUIT OF A PRACTICAL ULTRA-LINEAR AMPLIFIER



The circuit is not different from a Playmaster except for the screen tappings on the transformer. Feedback values are also a little different. This is a perfectly practicable amplifier and gives excellent result up to about 6 or 7 watts of power which in many cases is enough.

trouble-free amplifier to provide about 10 watts as a record player. Such an amplifier was the Playmaster No. 2 using a pair of 6V6 valves in push-pull, and the Playmaster Seven, which was a later version using 6BW6 valves with similar characteristics.

But the Playmaster series included a triode amplifier with about 8 watts output, and we still receive letters from readers claiming that one is better than the other.

CLASSIC BATTLE

From some points of view it would be a very poor thing if ever this triode-pentode controversy was settled. So many of us would be deprived of our honest amusement and good argument!

A circuit which has recently come in for a good deal of discussion is the "ultra-linear" circuit. It isn't at all new—there is evidence that it was known in Australia as early as 1935, and articles about it have appeared in overseas journals on a couple of occasions since the war.

The term ultra-linear is one of those catchy appellations which is more picturesque than apt. The circuit uses a pair of pentode valves with a special screen connection which makes them behave as much like a triode as a pentode, and is more correctly termed "partial triode" as an alternative to "ultra-linear". This is a better term because, although the linearity of the circuit is improved, this is not the only change which comes over the valves when used in this way.

The circuit requires an output transformer with a tapping between the HT feed-point and the plate end to which the screen is connected. Thus part of the output load of the plate is made available for the screen.

The connection of a pentode for use as a triode is to wire the plate and screen together. This is equivalent to placing the same impedance in the screen and the plate circuit. Thus if we move the screen connection down the winding toward the HT point, we get a gradual transition of the valve's operation from triode to pentode characteristics. By selecting the optimum position for the screen tap, we can find an operating point which combines some of the characteristics of both triode and pentode.

NOT TRUE TRIODE

The operation of a pentode in an ultra-linear circuit is more clearly understood if we remember that, even with the plate and screen connected, it does not actually become a triode, although it behaves like one. The screen is still a most active element, and controls the operation of the valve just as surely as when connected as a pentode. The maximum voltage which can be applied to the valve depends on permissible screen dissipation rather than plate dissipation, assuming the same voltages are used for each electrode.

What really happens is that, in connecting the screen to some point on the output transformer, we apply negative feedback to it in a manner which will be determined by the valve geometry, which determines the degree of control exercised by the screen. When it is connected directly to the plate, we are using the maximum possible feedback allowed by this method, and when connected to HT there is no feedback at all.

IMPORTANT CHANGES

The changing characteristics of the valve is due entirely to this effect. A triode-connected pentode is, therefore, more correctly described as a pentode with maximum screen feedback, but it is still a pentode.

This fact is apparently not appreciated by some writers on ultra-linear circuits.

The three most important changes which take place in this transition from pentode to triode operation relate to power output, distortion, and effective output impedance. These changes are by no means linear because the control of the screen itself is not linear. It is, therefore, necessary to determine an optimum tapping point for each type of valve to give the most favorable combination for ultra-linear connection.

It is possible to arrive at this combination by calculation, but because the results have to be related to specific transformer types, it seems more profitable to make final selections experimentally. Generally speaking, it appears from published

IT'S NEW! And completely self-contained!

Goldring PLAYGRAM PORTABLE

3-SPEED RECORD PLAYER AND AMPLIFIER

(No need to plug into a Radio . . . Playgram does the whole job!)

Brings you recorded music wherever there's a Power Plug!

The new light-weight Goldring "PLAYGRAM" is the perfect answer to your record-playing requirements! Not just a pick-up and motor, it incorporates a **high-grade amplifier**, with tone and volume control . . . plays your records wherever there's a power point — at home, at parties; for musical evenings, at week-enders, on holidays.

CHECK THESE GOLDRING "PLAYGRAM" FEATURES:

- ★ Plays microgroove and standard records.
- ★ Plays 3 speeds, 78, 45, 33 1/3.
- ★ Plays 12in, 10in. or 7in. records.
- ★ Incorporates the world-famous B.S.R. GU.4 motor.
- ★ Pick-up has extended frequency response for life-like tone.
- ★ "Silent sapphire" styli eliminate needle chatter.

PRICE COMPLETE, 27 GNS.

● NOTE! . Lid unhinges when unit is in use.

"TRANSCRIPTION" QUALITY REPRODUCTION . . . at low cost, with MOTOR and PICK-UP UNITS

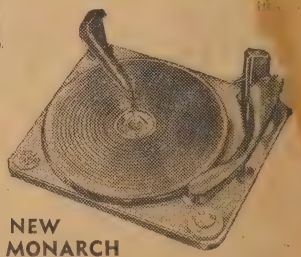
BRITISH B.S.R. THROUGHOUT

B.S.R. MU.14 3-SPEED MOTOR

No belts of any type are used and smoothness of action is assured by employing the B.S.R. de luxe 4-pole motor which is noted for its low rumble and vibration factor. External knob speed change. Retail Price £7/10/-.

B.S.R. GU.4 3-SPEED MOTOR PICK-UP UNIT

Powered by de-luxe 4-pole induction rim drive motor with external 3-speed change knob and automatic stop. Light weight twin sapphire crystal turnover cartridge, gives excellent response. Retail price £13/15/-.



NEW MONARCH AUTO-MATIC RECORD CHANGER

Plays 7in., 10in. or 12in. discs at 33 1/3, 45 or 78 r.p.m. Extended frequency range to 10,000 c.p.s. Ten record capacity — intermixed. 27 Gns.

GOLDRING ENGINEERING (AUSTRALASIA) PTY. LTD.

57 H.E. AREA, ST. MARYS. N.S.W. Phone BO701, Ext. 447.

data that between 10 and 25 pc of the plate impedance represents the region in which we will be interested. For purposes of experiment we built the amplifier of which the circuit is given here, using 6BW6's, which are similar to 6V6's in their behavior.

It soon became obvious that published reports were in conflict on major matters. Chief of these concerns power output. For instance, Haller and Keroes (Audio Engineering, Nov., 1951) claim that with a 25 pc tapping, 90 pc of the pentode power output would be obtained from 6V6's. D. T. N. Williamson and P. J. Walker (Wireless World, Sept., 1952) disagreed with this figure, and offered the much more likely figure of about 65 pc. Other disagreements appeared on the precise degree of advantage to be gained by the connection, and we became rather intrigued to see what our own results would be.

CIRCUIT

The circuit of the amplifier used is given here. It is quite straightforward and is actually the recent Standard amplifier with provision for changing the output transformer and experimenting with various screen connections.

It is convenient in that, with no other changes, it can be operated either in a pentode, triode, or ultra-linear circuit, so that a comparison between their operating conditions can be made quite simply.

The series of tests carried out included a check on power output with various screen tapping conditions, the measurement of voltage output across various resistive loads connected to the 15-ohm secondary, and some distortion tests for both pentode and ultra-linear operation.

The first task was to determine to what extent various screen tapping positions caused variations in power output. Tests were made to check the output with both pentode and triode operation as representing the two extremes between which it was desired to find an optimum point.

Several transformers were used for this work, made by different manufacturers. Two of them had screen tappings at 25 pc, one at 17 pc, and a fourth had tappings at 10, 14 and 18 pc.

IMPEDANCE RATIO

Incidentally, this percentage refers to the ratio of screen and plate impedance, not to the turns ratio of the transformer. Obviously the 25 pc tapping is made at the mid-point of each half of the transformer, as a reduction of one-half the number of turns will reduce the impedance to one-quarter of its original value.

Because all these transformers exhibited slightly different degrees of efficiency, the results as expressed here in curves and figures are not completely consistent, but they are quite near enough to show up the changes we expected to see. Our tests were intended as preliminary work, and not for the production of accurate design points.

All the curves shown in Fig 2 were taken for the same terminal voltages, but these were not quite the same when the distortion curves shown in Fig 3 were run off.

The power output checks were made with an input at 1000 cycles from a sine wave generator feeding a 16-ohm resistive load, the output voltage being read on an output meter and overload point checked by reference to oscilloscope wave-form. This method ignores an exact figure of distortion, but what did exist at full output can be considered as a constant in each case.

The output was first measured with the pentode connection, using about 15 db of feedback to make the overload pattern on the CRO easier to distinguish. All the transformers showed approximately the same output which we can average out at 10.5 watts into the secondary. As the calculated primary output was nearly 12 watts, this exhibited a reasonable degree of efficiency.

Connected as triodes, and using the same transformers, the output averaged 3.3 watts, which is near enough to 30 pc of the pentode output. This again lined up quite well with what could be expected. It illustrates, also, that whereas 10 watts can be considered a satisfactory minimum figure for a good amplifier, the output in triode connection is too low to be useful.

With all the transformers with the 25 pc tapping, the output dropped to approximately 65 pc of the pentode figure, representing a similar number of output watts.

OUTPUT FIGURE

Tests with 18 pc taps gave a little higher output — about 68 pc—and with 14 and 10 pc about 75 pc of pentode output.

The fact that these last two figures were so close may indicate that they represent about the optimum point for output power, although it is obvious that there is a definite relationship between the screen tapping and available power. To establish a reliable curve would call for a somewhat tedious process with a

CURVES FOR OUTPUT IMPEDANCE

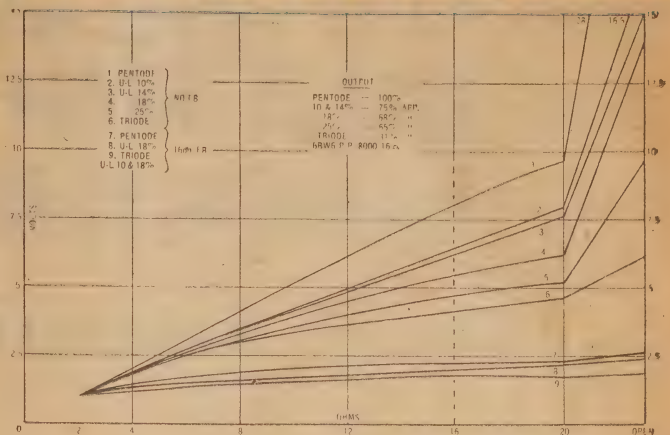
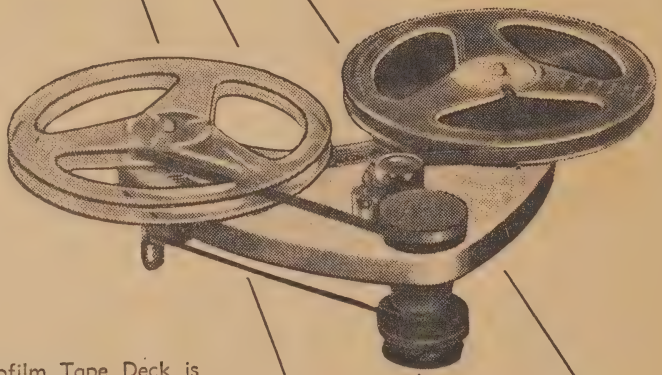


Fig. 1—These curves show the voltage changes across the output load when varied from 2 ohms to open circuit for different operating conditionis. The ultra-linear positions all show an improvement over pentode connection, and this is maintained even with the addition of inverse feedback.

Fig. 2—Amplifier frequency response using one test transformer show an improvement for the ultra-linear connection. This curve shows also the effect of a bypass condenser in the feedback network.

NOW AVAILABLE DIRECT FROM THE MANUFACTURERS ..

THE MAGNOFILM TAPE DECK, MODEL TM-1



The Magnofilm Tape Deck is designed for electrically driven turntables — 7 inch reels hold 1200 feet of tape, record 74 minutes at 33 1/3 r.p.m. and 32 minutes at 78 r.p.m. Tape may be erased and re-used with Magnofilm Eraser supplied.

- Fits on your radiogram or turntable.
- Records from radio, microphone or disc.
- Plays back with lifelike quality and fidelity through your radio or amplifier.

£17/10/0

Plus Tax ex factory Melbourne

Call, telephone or mail your order now for this unique "factory-to-you" offer which will enable you to record on tape at the lowest cost ever achieved—*with the best recording equipment available in Australia.*

Byer INDUSTRIES Pty. Ltd.

8 DORCAS STREET, SOUTH MELBOURNE, VICTORIA

special transformer wound with a large number of taps throughout the windings.

It does appear to indicate, however, that the figure of 90 pc of the pentode power for the 18 pc tapping, which has been given in some overseas reports is in error, and this finding is substantiated by the experience of others whose results are available to us.

In practice, the difference between 65 and 75 pc of the pentode power isn't appreciable, so that we will have to refer to the effects of tapping point on distortion and output impedance to decide on what is optimum for various types of valves. It is likely that this point will not be the same in every case, because the screen characteristics vary from one valve type to another.

VOLTAGE RATINGS

Before leaving this matter of power output, it should be mentioned that higher values of power output can be obtained by using higher plate and screen voltages for the 6V6 and 6BW6. We have seen designs using up to 318 volts between cathode and plate/screen.

The valve makers will not agree to such ratings, although in many cases they may be used with no apparent ill-effect. Such a voltage might well produce about 15 watts in pentode connection, and almost 10 watts for ultra-linear, but we cannot recommend it in the light of the maker's limit of 285 volts.

It is true that, when the valves are delivering power, the dissipation at both plate and screen will be reduced because the valve shares some of it with the load, but we cannot design amplifiers on the assumption that they will always be delivering full output or somewhere near it! Most of the time, only a fraction of the maximum power will be used.

In order to observe the effects of ultra-linear connection on the reduction of distortion, which is the second point claimed for it, we carried out measurements on intermodulation distortion with two test transformers, made by different factories, but each with a screen tapping point of 25 pc. When these tests were made, the multi-tap transformer, unfortunately, was not available.

LOWERED DISTORTION

The curves shown in Fig 3 do indicate a considerable reduction for the ultra-linear connection, together with a very much better slope toward overload conditions.

At 4 watts it is only about 1 pc and about 2 pc at 4.75 watts. For the same output the pentodes show nearly double this figure, and rise to over 5 pc before their useful output maximum is reached.

Unfortunately, it was not possible for us to run a complete distortion analysis of the amplifier, and it is not clear from these curves how they relate to harmonic distortion. It should be mentioned that the valves were not specially balanced for the occasion, and it is likely that, if they were, the difference would be even more apparent.

Checking with some distortion figures made elsewhere, however, we find that the reduction in third harmonic distortion is the most impressive, and can reach an average of 10 times or a drop from say, 1 pc to .1 pc.

At the same time it is clear that the overall improvement will only be really effective if care is taken to balance the valves to reduce second harmonic distortion to a minimum. With pentode operation, the thirds may well be as high, if not higher, than the seconds for unbalanced valves, even when new, and the ultra-linear connection does little, if anything, to alter second harmonic distortion.

Good balancing can easily reduce second harmonic distortion by at least five times as between pairs of new valves, which should ideally exhibit the same Gm and draw the same plate current for equal amounts of bias.

In fact, it seems clear that if the extremely low distortion figures given for high quality amplifiers are to be realised, they must be fitted with balanced output valves when placed into operation, and the valves checked for balance regularly throughout their useful lives. Otherwise they will undoubtedly change with age, and the total harmonic distortion might well rise to many times its initial low figure.

The distortion due to harmonics higher than the third is generally low in a good amplifier, even nearing full output, and from actual figures are observed to average about .05 pc, or even less.

A case can be quoted of a valve pair which, as pentodes, showed a third and fifth harmonic distortion of 1.46, but which was reduced to .09 pc by ultra-linear connection. The output was about 10 watts, maximum pentode output being about 15 watts at commencement of grid current.

VALUE OF BALANCE

At the same time, the second harmonic distortion was .8 pc for each case, a figure which could have been appreciably improved by balancing.

It seems, therefore, that ultra-linear connection can give a very valuable reduction in odd harmonic distortion, with a corresponding reduction in intermodulation distortion. It is probable that this reduc-

COMPARATIVE DISTORTION TEST

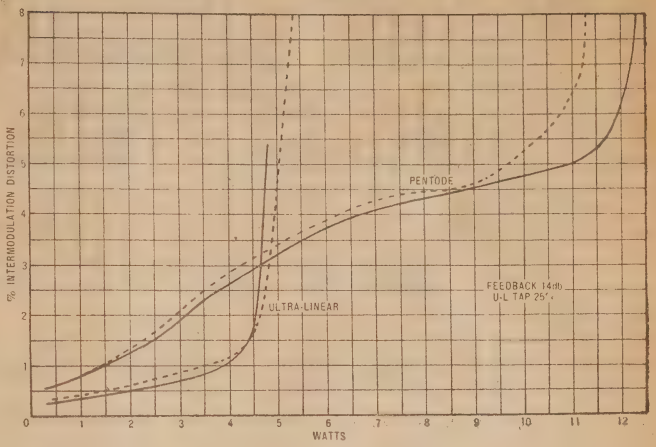


Fig. 3—Intermodulation distortion curves for two different transformers illustrating the big improvement for the ultra-linear circuit. Plate voltage was a little lower than the maximum permissible when these tests were made. They are, of course, for the complete amplifiers.

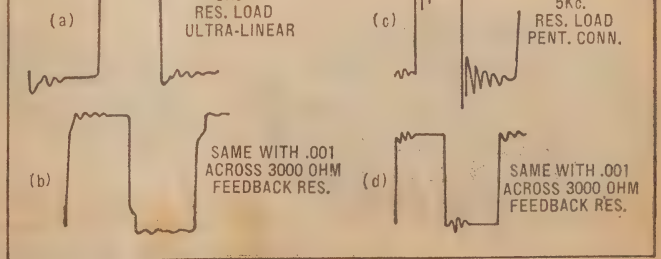


Fig. 4—Square wave tests show the reduction in ringing which occurs when changing from pentode to ultra-linear operation. This transformer was not the best of the group used.

TWO NEW MAGNIFICENT Hi-g

acos

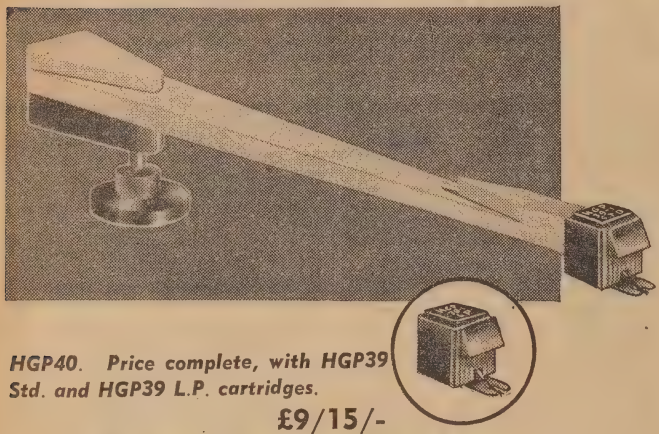
CRYSTAL PICKUPS

HGP40 ***Interchangeable Head***

AND

HGP38 ***Turnover Type Head***

will track with ease all present day records—
and those of the foreseeable future too



HGP40. Price complete, with HGP39 Std. and HGP39 L.P. cartridges.

£9/15/-

HGP40 CHARACTERISTICS

Response flat from 40c/s to 13 Kc/s with an overall response from 20 c/s to 17 Kc/s. Tracking weight 8 grammes.

HGP39-1STD.
Output 1 volt on standard records. Incorporates easily changeable 0.00025in sapphire stylus.

HGP39-1LP.
Output 1/3rd volt on microgroove records. Incorporates easily changeable 0.0001in sapphire stylus.

HGP38 CHARACTERISTICS

Output 1 volt on standard and $\frac{1}{4}$ volt on long playing records. Tracking weight 10 grammes maximum. Response characteristic smooth with no resonance. Cartridge works into load resistance of $\frac{1}{2}$ megohm and crystal capacity of 1000 picafarads ensures adequate bass response.

Price complete with HGP37 Cartridge
£5/15/-

. . . and NOW YOU CAN GET ACOS Hi-g HEADS FOR GP20

Australian Agents: **AMPLION (A'sia) PTY. LTD., SYDNEY, N.S.W.**

tion brings over-all performance very close to that obtained from the same valves used as triodes.

Second harmonic distortion, however, is not reduced by ultra-linear circuits, although it is not as distressing to the listener as distortion due to thirds.

The third matter to be examined was the performance of the amplifier with pentodes, ultra-linear and triode connection under conditions of load varying from 2 ohms to open circuit as presented to a 15-ohm output winding of the transformer.

No feedback was used for the first series of tests in order that the results would not be masked by its effect on output impedance.

OUTPUT IMPEDANCE

The input to the amplifier was set in each case so that 1 volt was developed across the 2-ohm starting point. The connection of a CRO across the output terminals of the amplifier made sure that it was not overloaded.

The results are shown in curves 1-6 of Fig 1.

The pentode connection, as might be expected, exhibited the greatest variation by a wide margin, varying from 1 volt at 2 ohms to nearly 10 volts at 20 ohms, and 28 volts on open circuit.

As the screen impedance was increased from 10 to 25 pc, a progressive improvement was noticed, until the 25 pc curve (5) compared quite favorably with the triode connection curve (7).

Quite clearly, the ultra-linear connection is most effective in improving output regulation, and it does so in proportion to the amount of screen impedance, although not directly. In this respect, the term "partial triode" is neatly demonstrated.

WIDTH FEEDBACK

The remaining curves (7, 8 and 9) show what happens when 16 db of feedback is applied to the amplifier.

The difference between them is not nearly so evident, and in the case of the 10 and 14 pc positions was not sufficiently separable from the triode connection to show on the graph.

It is not clear why the 18 pc position should not have shown up to better advantage, but it may have been due to the difficulty in adjusting the feedback to exactly the same amount in each case. However, a check on results did not reveal any error of measurement, and the point must rest there until more accurate checks are made in the future.

The conclusion can be made, however, that although the application of feedback makes all these curves look good, the ultra-linear still comes nearer to the triode conditions than does the pentode, and with sufficient margin to make it a useful improvement.

It also demonstrates the great value of feedback in obtaining good loudspeaker damping, for these curves show virtually constant voltage output between 8 ohms and open circuit. The position is not quite as represented, however, for the change in output load also changes the degree of feedback effective in the amplifier.

This change is much the same in each case, and therefore the curves are useful on a comparative basis.

A calculation of power output under conditions of varying load shows that although there is not a great amount of change between 12 and 20 ohms, the optimum point seems to lie about 16 ohms, which corresponds to 8000 ohms plate to plate load for the valves. This is the value of load recommended for pentode operation of the valves, so it would appear that it is also near enough to optimum for ultra-linear operation.

This conclusion is borne out by other figures we have on this circuit. It is no doubt coupled with the fact that the recommended load for triode operation is the same!

It does mean, however, that the output stage is not critical as to the plate-to-plate impedance.

To complete the picture, a check was made on the frequency response of several transformers, one of which is shown here as perhaps the most significant for our purpose. It was not built for extremely wide response (in fairness to the manufacturer), but nevertheless it shows up the effects of the ultra-linear connection.

PENTODE CURVE

Curve 1 of Fig 2 is for pentode connection with 24 db of feedback, and shows a hump at 60 Kc which is characteristic of many transformers. The fact that this hump is less noticeable with only 14 db of feedback illustrates the increase in phase rotation at this critical point which could cause oscillation and ringing when excited by transients.

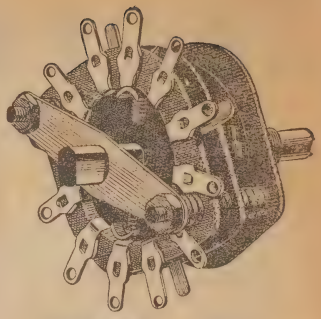
Curve 2 shows the same conditions but with a bypass condenser across the feedback resistor. This has reduced the extreme top response by about 13 db at this point, and has pushed the peak down to a safe level at which oscillation would be improbable. It will be remembered that this condenser is often fitted to amplifier circuits for this purpose, and although it degrades the response curve, it contributes to the stability of the circuit. It is in fact typical of perhaps the majority of pentode amplifiers of good quality and has reduced the response at 30 Kc by only 1 db.

ULTRA-LINEAR CIRCUIT

Curve 3 shows the ultra-linear connection with 19 db feedback, which happened to be the figure consequent on the reduced gain. This has possibly made the curve look a little better than it would be with a higher degree of feedback, but it is nevertheless a big improvement over the pentode. No bypass was used with the feedback resistor, and there was no sign of oscillation. It is in fact an extremely good curve, being about plus or minus 1 db to virtually 90 Kc.

The improvement is probably due to the extra damping provided by the addition of the screen impedance to the load, and the increase in circuit capacitances which have obviously moved the peak farther up the scale.

This is likely to be typical of the ultra-linear circuit, and we can expect better stability as a result and a more linear response. However, a great deal of the behavior of any amplifier in this region will depend on the design of the output transformer, and the addition of the screen



PALEC ROTARY
10 AMP. **SWITCH**

(World Patents pending)

GENERAL: It is the only Single or Multi-Pole Rotary Selector Switch which combines 10 Amp. current capacity with small physical dimensions. It is interchangeable and can be used in conjunction with an "Oak" type assembly.

Mechanical Operation Test. The Palec Switch has withstood 50,000 revolutions at 60 R.P.M. without mechanical failure.

RATING—10 Amp., 250 V.A.C.

CONTACTS—
Silver Plated—non-shorting only.
Resistance—800 Micro-Ohms.

TEMP. RISE ON CONTACTS—
(with 10 Amp. Conductors)
at 10 Amperes 10° C. rise
at 20 " 30° C. rise
at 30 " 50° C. rise

DECKS—1 to 8 max.

POLES PER DECK—
1 Pole—max. 12 contacts
2 Pole—max. 6 "
3 Pole—max. 4 "
4 Pole—max. 3 "

OVERALL DIAM., 2-1/16 in.

TECHNICAL SERVICES—
We will design and build Switches to requirements.
Available—leading Wholesalers.
Quantity prices on application to:

PATON ELECTRICAL PTY. LTD.
90 VICTORIA ST., ASHFIELD, SYDNEY

"IT'S" BACK AGAIN

A SUPERB CRYSTAL MICROPHONE INSERT

THE "ACOS" MIC 19-4

- Frequency response flat from 40 to 6000 c.p.s.
- High output level — 50db.

Price **£1'19'6**

Available from leading radio houses everywhere.

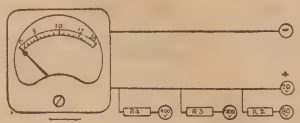
COLLINS RADIO

Mail Order Service Fastest and Cheapest in the Commonwealth

409 LONSDALE STREET, MELBOURNE, C.1., MU1033

Goods sent by ordinary parcel post, except when over 11lb, which are sent by rail, freight payable your end. Postage rates shown against goods advertised. For registered post send 1/- extra. Goods required air-freight sent F.O.N. unless air-freight charges remitted with order. To save delay send exact amount (M.O., Postal Notes, Stamps, Cash, Cheque [add exchange]). If in doubt about prices and postage on goods not advertised, send ample money. Change refunded with parcel. Order by part number and brief description of goods. Refer to page and date of advertisement in Radio and Hobbies if possible

COLRAY CIRCUIT, A CHEAP, FIRST CLASS MULTIRANGE VOLTMETER. ENGLISH MOVING COIL METER, JEWELLED BEARINGS, 5 MILLIAMP MOVEMENT, POWERFUL MAGNET.



R1 is already inside meter—20V. Reads direct.
R2—12,000 ohms 1 watt 1%— 80V. Multiply readings by 4
R3—36,000 ohms 1 watt 1%—200V. Multiply readings by 10
R4—76,000 ohms 1 watt 1%—400V. Multiply reading by 20

NOTE: If internal 4000 ohm resistor is shorted or removed, meter becomes 5mA meter.

METER	RESISTORS	TERMINALS
19/6	2/6 each	11d each

POST FREE

URANIUM R & H GEIGER COUNTER

Complete in every detail. Neon Flash Indicator and Phones. 5lb weight . . . . . £30/-/- Post Free

G.10H. GEIGER TUBES £13/2/6 Post Free

URANIUM Sulphate Crystals for testing Geiger Counters . . . . . 2/6 Post Free

VALVE SPECIALS

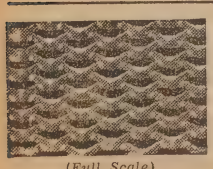
1A5+	12SQ7
1D6+	31
1F5+	33
1H4+	36
1J6+	37
1K4+	39
1K5+	53
1K6+	71A
1E7+	82
1G4+	FC13
2B7	KR20
5Y4G	TDD13C
6A6	14C5
6C5GT	14C7
6D8	14W7
6F5	14S7
6L5G	14F7
6L7	7A6
6S7G	954
6SS7	955
7C7	9003
7W7	12SK7

ALL ONE PRICE ALL BRAND NEW **5/-** ea.

Plus 6d. Postage

+ These are battery valves suitable for simple Reinartz receivers.

374 STANDARD TYPE VALVES AVAILABLE.
USE OUR FAST QUOTE SERVICE FOR PRICES.



(Full Scale)

Expanded Aluminium

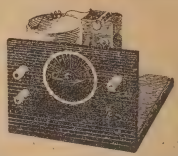
Suitable for speaker grilles etc., can be used natural, or sprayed any color.

13½ x 27in	30/-
13½ x 13½in	15/-
13½ x other inches	1/6 per inch

PACK AND POST 2/-.

PROVEN COLRAY LONG DISTANCE CRYSTAL SET

PLUS 3/- POSTAGE



- COMPLETE IN EVERY DETAIL.
- PROVED CIRCUIT.
- HIGH SENSITIVITY 4A42 GERMANIUM DIODE DETECTOR.
- 4K17 ARMY DISPOSALS 'PHONES*.
- 100 FEET AERIAL WIRE.
- LOUD, CLEAR RECEPTION WHEREVER A CRYSTAL SET WILL WORK. **£3'17'6**

*BROWN'S High Sensitivity 'Phones can be supplied instead of 4K17 — 30/- more.

BARGAIN TRANSFORMERS

FIRST GRADE IRONCORE POWER-TRANSFORMERS. FLAT MOUNTING. 2 7/8 x 3½ x 1in core. Primary 220 and 240v 50 cycle A.C. Secondaries 200-0-200v 40MA and 6.3v 2A. NORMAL PRICE 43/-.
OUR PRICE (add 4/4 Postage) 25/-

GENUINE OAK WAFER SWITCHES

Two Wafers, each with 4 single pole 4 position switches (8 switches). Numerous variations can be made up by the experimenter. Shaft 2in long. NORMAL PRICE 17/5.
OUR PRICE (add 6d postage) 10/-

TELEVISION EXPERIMENTERS BRAND NEW CATHODE RAY TUBES

5BP-1
SYLVANNIA & RCA.

U.S. Price
$22.50
WHILE THEY LAST.
OUR PRICE
£2/10/-
PLUS 5/- PACK & POST.

Phantom Radium Ray

PRESS BUTTON SWITCH CAN BE SEEN IN THE DARK

English rating 5 amp. 230 volt A.C. Available in pastel shades, pink, blue, brown, green, ivory. Modern finish in streamlined plastic. (2¼" x 2¾")

3/6

Post Free

FAST QUOTE SERVICE

For quickest possible service, write on the left-hand side of a sheet of paper the radio parts that interest you — one beneath the other. If a kit, itemise. Add your name and address and send it to us with a stamped, self-addressed envelope. We will add the latest prices and return to you. Use this sheet as your order form and return to us with remittance for cost and postage as quoted. Goods will be sent same day. Any surplus refunded. Sorry, no C.O.D.

EVERYTHING FOR THE RADIO & ELECTRICAL EXPERIMENTER

connection by no means indicates that greater liberties can be taken with quality.

Further information on the behavior of the amplifier is shown by the oscillogram tracings made with the same amplifier as was used for the frequency curves.

The first set—Fig 4a—shows the ultra-linear connection when the amplifier was excited with a square wave at 5 Kc.

Some ringing is apparent at the peak of each wave front, but it is not excessive and is damped fairly quickly.

A marked improvement in the amplitude of the overshoot is seen with a condenser connected across the feedback resistor. The value used has rounded off the top corner to some extent, indicating that it was a little larger than optimum. Considering the transformer used, it is a creditable result.

PENTODE CONNECTION

The second pair of traces refer to the amplifier with pentode connection, and here the overshoot and ringing are most pronounced. They are most probably the result of the peak seen on the response curve, and would have not been so severe with a lesser degree of feedback.

The addition of the condenser across the feedback resistor has made a dramatic improvement on the waveform. The overshoot has now fallen to a reasonably safe limit, although the overall picture is still not as good as for the ultra-linear connection, and not much better than the former without the bypass.

There are, of course, differences of opinion as to the importance of such severe square wave tests showing a comparatively small amplitude of ringing which is damped out in the early stages of the flat top. It might be considered that such a steep wavefront does not occur when reproducing musical instruments, and is approached by very few. A good deal of research seems indicated to relate with accuracy the effect on transient response of such comparatively small amounts, although it is obvious that in the case of the pentode in Fig 4c the ringing is severe, and continues throughout the duration of one cycle into the next.

OSCILLATION

Such a picture could represent actual oscillation of a continuous nature throughout the duration of the signal impulse, and should not be tolerated.

However, in this case we are particularly interested in the comparative behavior of the amplifier under the various connections, and from a comparative point of view such measurements are most valuable in estimating the relative merits of the circuits.

Our remarks to this point have referred to an amplifier using valves of the 6BW6 or 6V6 type. The results quoted show that an extremely good amplifier can be built using them, but they also indicate that the amount of power output is not enough to satisfy the requirement or a high quality design.

The price to be paid for using higher powered valves need not be very great. There are several types which look good with a terminal voltage of below 300, giving much higher output with low degrees of distortion.

A glance through some manufacturers ratings show that a pair of 6L6's will give about 18 watts for 270 volts at 2 pc distortion and a standing current of 134 mills, the load being 5000 ohms.

The KT66's will give 17 watts for 250 volts at 4 pc, standing current 162 mills and load 4000 ohms.

The EL37's will give 20 watts for 250 volts at 2.3 pc distortion and a standing current of 118 mills with a 4000 ohms load.

The bias for these valves is between 15.6 and 17.5 volts, so that they are about twice as difficult to drive as the 6V6's.

On the other hand they cost only a shilling or two more, so that a larger current rating for the power transformer looks to be the main extra item, with the possible addition of a stage to supply higher over-all gain for comparable amplifier sensitivity.

As the next step, therefore, an amplifier similar to the first was constructed, but arranged so that either 6L6G's or EL37's could be used in pentode or ultra-linear connection. A 285 volt per side transformer was used with a primary voltage tapping to allow slight variation in HT voltage.

OUTPUT CHECKS

Some ultra-linear type transformers were wound up having various tappings, some of which have not yet been tested. The load was set at 4500 ohms as a useful compromise for any of the valves in this class.

This amplifier delivered about 17 or 18 watts of power in pentode connection, which is what might be expected.

When altered to ultra-linear connection, the 6L6's dropped their output to about 70 pc of their pentode power. The EL37's on the other hand produced if anything slightly more power than they did as pentodes.

It was further observed that the distortion for the EL37 valves was somewhat higher in pentode connection than the 6L6's. In ultra-linear connection, however, the position was reversed, and the EL37's gave a very low figure of intermodulation distortion up to a useful figure of about 15 watts.

As a further check, several transformers were used, including an English Partridge type tapped at 17 pc for ultra-linear connection, but otherwise intended for use in a Williamson circuit.

The figures were substantially the same.

As the only significant change in the amplifier was that of the valve types, it would seem that this interesting result is associated with the

(Continued on Page 95)

BRADMATIC

THE ENGLISH PRODUCT WITH THE UNIVERSAL REPUTATION

HI-FI TWIN TRACK RECORDER HEADS.

New consignment from U.K.
5R.P. Record/Play frequency range 30-12,000 c.p.s. £6/3/-
6R.P. Record/Play as 5R.P. except for considerably improved frequency response and .0002 gap width £7/3/-
5E Erase Head. Erase frequency 30-100 k/cs. Erase power input. 2 watts. £6/3/-

DIAMENSION ALL HEADS.

Diam. .970in.
Single mounting stem 1.125in.
Height from panel ¼in.
Also Bias rejector coils, play back amplifiers, recording amplifiers, oscillator coils, empty reels, all sizes.

Sole Representatives in Queensland, New South Wales and Tasmania for BRADMATIC LIMITED, Birmingham, England.

BRADECK RECORDER Company
MITCHELL ROAD, CRONULLA
Phone LB4402

PRICE'S RADIO

JANUARY SALE

HUNDREDS OF BARGAINS

ALL ODDMENTS TO BE CLEARED REGARDLESS OF COST

CONDENSERS. 2 Gang for broadcast band with short wave section 5/-

I.F. TRANSFORMERS STC 455 kc. 2¼in square cans 2/-

AMPHENOL Cable Connectors 4 pin per set 1/-

SWITCHES. DP-DT plus Off-on. Ideal for AC/DC meter switching etc 1/-

POTENTIOMETERS Aerostat 0.5 and 0.05 meg only 1/6

PHONE UNITS. L.R. Used but guaranteed 2/-
Head bands for above 2/-

HUGE REDUCTIONS ON ALL STOCKS OF GRAHAM FARISH TRAINS ETC. AND STABA CONSTRUCTION SETS

PRICE'S RADIO

5-6 ANGEL PLACE, SYDNEY.

Here's your answer, Tom!

Tom has obviously become interested in building a small set but he's not prepared to follow instructions blindly. He has an idea that he can get away with fewer coils than we specified in the descriptive article.

AFTER having referred to several of our small sets, Tom gets around to his question about the set for young d-xers.

Why can't I increase the frequency coverage of some of the coils by switching a capacitor in parallel with the tuning gang? I noticed that you suggested some such scheme in one of your amateur receivers.

Yes, we might have made some such suggestion, Tom, but there's more to it than that. You can rest assured that we don't like winding coils either, and we wouldn't have set about winding them all up and extracting all the data if there had been an easier way.

The important point to remember is that the efficiency of a tuning circuit in a little set like this—in fact, any set—has a lot to do with the "L/C ratio". This is the ratio of inductance (L) to capacitance (C). You really want plenty of inductance, but

"I think I just broke Ohm's Law."

not too much capacitance across it.

Without getting too deeply involved in figures, it transpires that one can't afford to have more than about 300 to 400 pF. across a short-wave coil. This is especially true of the shorter waves—or should we say the higher frequencies, around 10 to 20 Mc.

In the "Set For Young D-xers" a full-sized tuning capacitor is used, with a capacitance of over 400 pF when fully in mesh. To try to add more capacitance in parallel with this again would result in very inefficient operation. In fact, there is every chance that the regener simply would not work, thereby dering the set useless.

The only cases where such parallel capacitance would be permissible is in receivers using low value tuning capacitors—as is common practice in amateur band receivers.

If you check up on your references, Tom, you will probably find that the sets in question all use tuning capacitors of 100 pF or less. A small fixed capacitor can be wired in parallel without too severely affecting the L/C ratio.

What is the difference between having the first valve untuned and one that is tuned?

That's a question, Tom, that quite a few people have asked us in recent months.

One can look at the question in two ways.

TWO WAYS

It may refer to a set with a converter valve in the first stage and normally tuned by a 2-gang capacitor. If one could eliminate the tuned input circuit, it would be possible to use a single gang, thereby saving cost and avoiding a lot of tracking and alignment problems.

Unfortunately, the scheme doesn't work too well because, with no tuned circuit ahead of the converter, there is nothing to prevent the reception of strong "image" interference, strong signals on other frequencies sufficient to produce cross-modulation and, lastly, the penetration of random signals directly into the IF channel.

Loss of gain isn't the real problem, you see, though it has to be considered.

As a result of all this, such sets are notoriously unpredictable in their behavior. In one location they will work quite well, in another they are hopeless.

Many folk, including ourselves, have experimented with the idea, but have always got back to the same conclusion . . . a superhet needs at least one tuned stage ahead of the converter.

TUNED STAGE

What's more, Tom, it needs to be an efficient tuned stage to combat effectively all the abovementioned troubles. That's why set designers normally prefer a litz-wound, iron-cored coil.

It's also the reason why some of the older dual-wave brackets, with rather piffling little broadcast aerial coils, were prone to "joeys" and "whistles".

So much for simple superhets. The same question could be applied to more complex receivers—sets with an RF stage. Can an untuned stage be used in these?

In actual fact, Tom, they are sometimes used, particularly where it is important to save space and weight.

Some car receivers, for example, are made with an untuned RF stage.

The aerial is fed into a normal high-gain coil, tuned by one section of a two-gang capacitor. This largely eliminates any problem with images, cross-modulation and spurious signals, exactly as it does in a set which has no RF stage.

It provides the best possible signal at the input grid and therefore largely determines the signal-to-noise ratio.

Normally, the plate circuit of this RF stage would be fed through the primary of a tuned RF coil, which further discriminates against any but the wanted signal. The difficulty is, of course, that this tuned circuit involves another coil and another section on the tuning gang.

"You called, sir?

To save this complication, some sets have been made without any tuned coupling between the RF and converter valves. The plate is supplied with DC through a carefully designed choke and the signals coupled via a capacitor to the converter grid.

The untuned coupling does not contribute to the signal circuit selectivity, all of which must be provided by the aerial coil.

But it does give gain and, while it is lower than it would be with a sharply-tuned coil, it is nevertheless useful.

In other words, Tom, it is possible to use an untuned RF stage in a set

(Continued on Pag 7)

of this kind and the overall performance lies midway between what it would be with a full-scale RF stage or none at all.

Is it possible in the future that the use of generators will be dispensed with in producing electricity. Will other methods of generation be invented?

It would be simply wonderful, Tom, if we could answer "Yes" to the last part of your question and then go on to suggest what the new methods would be.

We might even manage to sell some advanced patent rights and retire on the proceeds!

No, we can't say what new methods are going to be invented, Tom, but we would be very surprised to see anything come to light in the measurable future which would seriously challenge the position of the rotary generator.

At the moment, vast sums are being spent on developing hydro-electric power schemes, using bigger and better generators.

A lot of research is also going into atomic power stations, but, once again, these will use conventional rotary generators, with the atomic reaction harnessed to produce steam and power the turbines to drive them.

Experiments to produce power directly by other means are on only a very small scale and one can hardly see them being developed for a very long time to come to the proportions necessary to meet industrial needs.

One such proposal is to harness the radiation from radioactive particles to produce a so-called "atomic" battery. The idea undoubtedly works, but it has so far been able to produce only microscopic amounts of power.

Yet another scheme is to harness the sun's radiant energy with banks of photo-sensitive cells. Here, again, only very small amounts of power are available.

No, Tom, we tip that generators will be whirring for quite a while yet.

Is it necessary for transistors to be shielded?

One can't answer this question with a straight-out "yes" or "no".

Up to the present, most transistors have been used in relatively simple circuits, notably audio, where the gain has been only moderate and the circuit impedance fairly low. Shielding isn't very critical in such circuits, irrespective of whether valves are used, or transistors.

However, in applications where the gain is high enough for feedback to take place between the input and output circuits, attention to shielding automatically becomes more necessary. And since transistors are so small anyway, it becomes as much as anything a question of shielding between whole circuits and stages—wiring and all—as it is of shielding just the transistor.

The technique is quite different from old-fashioned radio valves, which had to be shielded from one another with the aid of large metal cans.

When you publish circuits using transistors, will you include a circuit without variable condensers?

Apparently, Tom, you have a set on variable condensers—or "variable capacitors"—to give them their more up-to-date name.

We used to feel the same about them in the old days, when we had to salvage them from junk counters and try to adjust them so the plates wouldn't scrape. We even had a special set-up using earphones and a torch battery to test them.

Since those days, manufacturers have learned a lot about making variable capacitors, and, for the most part, they are now very reliable components. The only real problem they introduce is in midget receivers, where the bulk of even the smallest gang is sufficient to cause some problems.

For this reason, there may possibly be a swing over to inductance tuning in midget receivers using transistors. But inductance tuning has its own problems, too, and has so far not enjoyed any great popularity with local manufacturers.

What we do in the matter will largely depend on the availability of components when the time comes. However, we can't see many transistor receivers being built until transistors come down a long way in price. Right now they're much too dear.

I have seen wireless waves drawn on paper. As they are invisible, how is their shape known?

Actually, Tom, you're under a misapprehension. You have never seen a drawing of a radio wave, any more than you've seen one of a light wave or a sound wave.

The patterns that one often sees in textbooks representing such things are really rudimentary graphs.

The wavy line which is often used to represent a sound wave is best regarded as a graph of the variation in air pressure (plotted in the vertical direction) against time (plotted in the horizontal direction).

Similarly, a radio wave might be thought of as a variation in a magnetic or electrostatic field plotted against time. We know from fundamentals that, in a pure wave, the variation follows what is known as a "sine" law, based on the sine of an angle. You may remember it, if you studied trigonometry at school.

We used to wonder at school why they wasted all that time over geometry and trigonometry. When we later became interested in electricity —and other things—we suddenly realised why, for the whole conception of alternating current is based on the things we learned at school.

Could you sketch various radio waves, broadcast waves, short waves, and so on?

Having read what we have just said, Tom, you will realise that there is not much point in this question.

Since the sketches you have in mind are simply graphs, the only difference would be that short waves (that is, higher frequencies) would show more alternations in a given time than the lower frequencies. Both follow the same basic sine-wave shape.

The RADIO MASTER

RADIOGRAM CHASSIS . . .

a great performer on Radio and Records

FEATURES:—

Eight valves, world range — Push pull output — Treble and bass boost — Inverse feed-back — R.F. stage — Three position switch for radio and gramophone — Switchpot for volume and power supply — Latest type high gain valves — Straight line edge lit dial in four colours — Moulded escutcheon plate, size 12¼in x 7in — 12in speaker, choice of Rola, Jensen or Magnavox — Six months' guarantee — Chassis size; 13in x 8in x 9in high.

Price £32/10/-

Freight extra

FIVE VALVE RADIOGRAM CHASSIS. PRICE £21/10/-

Cocktail and Standard

RADIOGRAM CABINETS

Many popular designs available including Swedish. First class finish. Send for Catalogue.

Cocktailgram cabinet as illustrated is 4ft 6in wide and supplied ready to fit your own changer and chassis. Centre section has four pieces of mirror glass (side to side), glass shelf, philenia lamp, automatic switch actuated by opening door and chrome plated accessories. Price: £58 plus £1 for packing, freight extra. Also available without glass to suit tape recorders.

ALL TYPES OF THREE SPEED RADIOGRAM UNITS

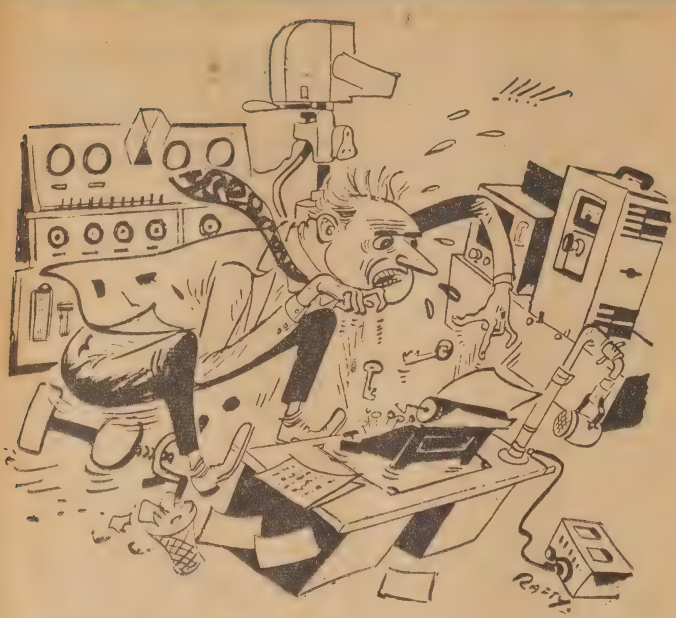
H. B. RADIO PRODUCTS

5 Carrington Street

Lewisham, SYDNEY

Telephone: LM5580

Established 23 years



Let's Buy An Argument

Having been taught that 2 plus 2 equals 4, 3 plus 3 equals 6, and so on, many readers find real difficulty in understanding how we can make similar additions and get smaller answers than they do. This applies in particular to power transformer ratings. To see what I mean, read the letter opposite, under the heading "Power Transformers".

by Neville Williams

THE question is one of those "evergreens" which most people seem to ask at one time or another.

We've answered it before, of course, and we'll certainly have to answer it again — many times — for each new batch of Radio and Hobbies readers.

On the surface it is indeed puzzling. We describe an amplifier like the "Playmaster" No. 7, which is, apparently, the one our correspondent has in mind. It uses a pair of 6BW6 output valves, preceded by two 6AU6's.

CURRENT ADDITIONS

This is preceded by a "Control Unit" using a couple of EF86's, with possibly a tuner ahead of that again.

The 6BW6's are like 6V6-GT's and draw as much as 50 milliamps each. That's common knowledge and it seemingly adds up to 100 milliamps for the output stage alone.

Coming to the 6AU6's, the data shows that these can draw a total plate and screen current of 15 milliamps with full voltage applied — and there's certainly plenty of volts available in the amplifier. This means 30 milliamps for the two 6AU6's and a total so far of 130.

The EF86's are more economical (fortunately), requiring only 3½ milliamps each, but it nevertheless pushes the total to 137, which is near enough to the figure quoted by our correspondent.

But let's add a tuner. Triode and hexode sections of a 6AN7 together require just over 10 milliamps. A 6BA6 looks like drawing up to 15 milliamps, with say another 10 milliamps per section for the 12AU7 — as in the latest wide-range tuner.

This adds up to 45 milliamps, with a grand total of 182 for the whole outfit.

Yet the Radio and Hobbies' design blithely specifies a 125-milliamp power transformer, with choke and rectifier to match.

Either those fellows can't add up or the components have a very large safety margin!

Actually, we can add up reasonably well, and we don't rely too heavily on safety margins. In fact, we prefer not to rely on them at all, if we can avoid it.

But let's run through the figures again, and examine the circuitry as we go.

VALVE USE

It isn't enough just to scan a table of figures and discover that a valve can draw so many milliamps. We need to assess how the valve is being used, what voltage is applied, what bias condition, what method of coupling, &c. Whether, in fact, it is drawing anything like its full rated current.

It is perfectly true that a single 6BW6 can draw 50-odd milliamps. One manufacturer quotes a total plate and screen current of 52 milliamps, when the valve is used under specified conditions as a single-ended output tetrode.

But the No. 7 Playmaster doesn't use the valve under these conditions. Over the page is a set of ratings for Class ABI Push-Pull operation. With plate and screen voltages of 285 and a self-bias resistor of 260 ohms, the valves draw a standing current of only 74 milliamps between them.

This is said to rise to 88.5 milliamps at full output, but such a condition is never achieved except when the amplifier is used to reproduce tone at maximum volume. As I understand it, only "mad dogs and Englishmen" do things like that.

OUTPUT STAGE

In the normal way, an amplifier delivers maximum power only on brief peaks, with the average power a long way below these peaks. If we further assume that the average listener doesn't run an amplifier to peak power, anyway, it becomes obvious that the output valves will never draw much more than their standing current — in other words, 74 milliamps.

Now let's look at the 6AU6's. First the phase splitter.

While a 6AU6 can draw 15-odd milliamps, it will do so only with an actual 250 volts applied to the plate, an actual 150 volts on the

screen and a bias of -1.0. This would occur only in video or RF service—and then only rarely.

The 6AU6 finds nearly all its application in audio amplifier stages and is mostly resistance coupled. This greatly modifies its operation and the amount of current it can draw.

In the case of the phase splitter, any current through the valve also has to flow through a lot of external resistance. There is the high tension decoupler, the plate load, the cathode bias resistor and the cathode load — a total of 130,000 ohms.

It is quite obvious that, even if the valve were a complete short-circuit, the current which could flow through the network from a 300 volt supply could not exceed 2.3 milliamps.

But, of course, the valve is not a short circuit and must introduce some additional impedance into the circuit. Therefore the current drawn by the phase splitter must be something less than 2.3 milliamps.

LOWER CURRENT

In point of fact, if a resistance-coupled amplifier is properly biased, the operating plate current will be approximately one half the short-circuit current through the network. We can therefore expect the phase splitter to draw about 1.2 milliamps, which is very different from 15.

Moving forward to the next 6AU6, it is obvious that the current through the 0.2 meg plate circuit could not possibly exceed 1.3 milliamps, with a likely operating value of about 0.7 milliamp.

Again, with correct operation, the screen current will bear a fairly constant relationship to the plate current. For the 6AU6 it generally ends up at something less than half the plate current, suggesting a figure of about 0.3 milliamp.

This adds up to 1.0 milliamp, making the total drain of the main amplifier 76.2 milliamps—or little more than half the former calculation.

It could, of course, vary by several milliamps from the predicted figure, because of variation in output valves, applied voltage and tolerance on the cathode bias resistor. However, 76.2 is the predicted design-centre figure.

Precisely the same sort of reasoning applies to the EF86's, which are also connected as resistance-coupled amplifiers. Neither plate circuit could possibly pass more than 2 milliamps, with 1.0 milliamp each being a likely operating current.

TOTAL RATING

Adding them together and allowing for screen current suggests about 3.0 milliamps for the Control Unit, or a total drain for the whole amplifier system of 79.2 milliamps.

In other words, the amplifier could run safely from an 80-milliamp transformer and this is what we suggested in the "Standard No. 1" amplifier. A 100-milliamp transformer, far from skimping things, would be very generous if no tuner were required.

But what of the tuner? The converter valve can draw up to 13 milliamps total current but typical operating characteristics suggest a figure of about 10, with the triode oscillating normally and minimum bias on the control grid.

READERS' PROBLEMS — OLD & NEW

"I want to try out an idea which I have had for some time but I do not want to go to too much expense until I find out if it would be possible.

"The idea is to have a 12-volt DC electric motor which would turn a 12-volt DC generator and also a 110-volt power plant for lights. The 12-volt generator would be used to charge the battery which, in turn, runs the motor."

The idea sounds fine until you begin to work out a few figures.

Let's say that you have a ½hp motor running to capacity. If it were 100% efficient, it would be delivering an exact ½hp and drawing just over 31 amps from the battery.

Now since the motor is delivering an exact ½hp, the two generators between them cannot absorb more power than this. In other words, if they, too, are 100% efficient, they can deliver 746/2 equals 371 watts. This and no more.

If the battery is to be kept charged as a first requirement, it will have to receive at least 31 amps, which is equal to its load current. But 31 amps at 12 volts is equal to 372 watts, which is the total power available from the system.

There is nothing left over to work the 110-volt generator. It cannot absorb any mechanical power and, therefore, cannot deliver any electrical watts. The lights must remain unlit.

Actually, the position is even more hopeless than this. The motor cannot be 100% efficient and will draw much more than 31 amps to deliver its ½hp.

Likewise the generator will deliver much less than 31 amps for the ½hp load it represents. You might put 40 amps into the motor and get 20 amps back from the generator, leaving the battery to discharge at a 20-ampere rate.

Rather futile, what!

Power transformers

I am puzzled in regard to the ratings of power transformers in your circuits. I have, from time to time, calculated the power consumption of circuits from the valve data books and, in some cases, it appears to me that the power transformer would be overloaded.

If I remember rightly, a recent Playmaster amplifier and control (the one using the EF86) ran out at 136 mA. consumption. Yet you specify a 125 mA. transformer which would be capable of supplying power to a tuner and state that, if a tuner is not used, a 100 mA. transformer would be large enough.

The Playmaster No. 5 specified a 125 mA. power transformer. According to the data book, the 2A3's take 90 mA. at maximum signal and, in the number 3 Control Unit, the two 12AT7's take 40 mA. between them, making the total for four valves 130 mA. And there are still the 6AN7, 6N8, 6AU6 and 6SN7 to be supplied.

To be on the safe side, I used a 200 mA. power transformer with a 5U4-G rectifier. Perhaps you would take up the question some time and give us some further information on power ratings. (R.T., Zeehan, Tas.).

A student's worries

I have a couple of questions to ask which have been worrying me for some time. I have asked several radio instructors, invariably meeting with the answer, "It's a bit beyond me".

It isn't very encouraging to a student. I might say that, of all the men I know associated with radio, and I mean all, it seems to be the practice to forget all the theory that isn't entirely necessary for practical work.

My chief problem relates to beat notes and sidebands:—

A modulated RF wave contains sidebands which are the sum and difference frequencies of the carrier frequency and the modulating signal. Assume carrier frequency of 1000Kc and a modulating signal of 1Kc.

This results in: (1) Carrier 1000 Kc. (2) Upper sideband 1001Kc. (3) Lower sideband 999Kc.

Now the definition for beat frequencies is this: When two alternating currents of different frequencies are present in the same circuit they have no material effect on each other and may be separated by the correct selective circuits but, when passed through a uni-lateral element, two new frequencies are produced which are the sum and difference of the two original frequencies.

Now to produce the required signal from a modulated RF wave, the wave is subjected to detection in a uni-lateral element. But, in this example, there are three frequencies present, so that the beat notes produced are:—

1000Kc plus 1001Kc equals 2001Kc.

1001Kc minus 1000Kc equals 1Kc.

1000Kc plus 999Kc equals 1999Kc.

1000Kc minus 999Kc equals 1Kc.

Now the sidebands must also beat together to produce other resultants as under:—

1001Kc plus 999Kc equals 2000Kc.

1001Kc minus 999Kc equals 2Kc.

All the higher frequency components would be filtered out but what of the 2Kc note which would be audible? To suggest that the sidebands don't beat seems ridiculous since, if they don't beat with one another, then neither would they beat with the carrier to produce the required 1Kc. (R.M., Ryde, NSW.).

MODERNISE YOUR PORTABLE WITH THE . . .

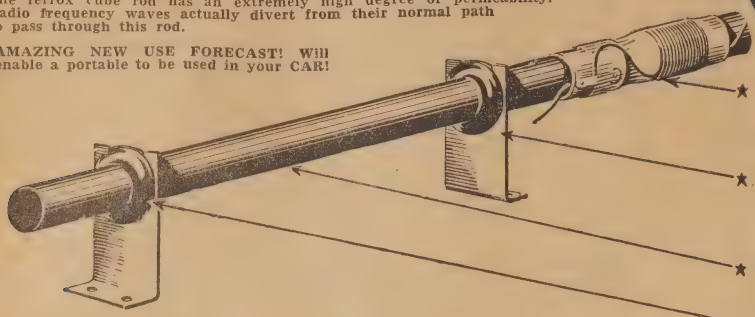
AEGIS SIGNAL MAGNET

LOOP AERIAL

RETAILS AT . . . 32/-

Supersedes ordinary loop aerials! Sensitivity and selectivity generally improved. The ferrox cube rod has an extremely high degree of permeability. Radio frequency waves actually divert from their normal path to pass through this rod.

AMAZING NEW USE FORECAST! Will enable a portable to be used in your CAR!



★ SPECIAL "HI-Q" progressively-wound TROPIC-PROOF COIL

★ ALUMINIUM MOUNTING BRACKETS

★ FERROX CUBE

★ RUBBER GROMMETS take care of shock, etc.

★ OVERALL Dimensions 8" long 3/8" diameter 1 5/8" deep with brackets in position)

★ Packed in special container with full instructions.

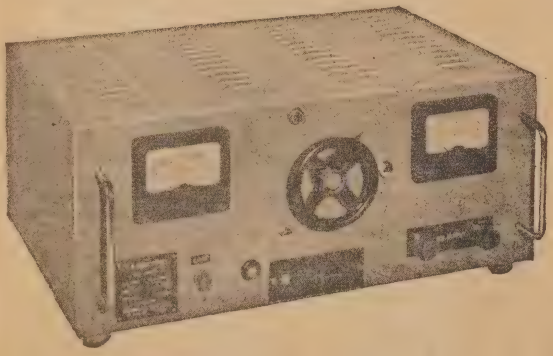
AEGIS MANUFACTURING CO. PTY. LTD.

208 LT. LONSDALE ST., MELBOURNE, C.1., VIC. FB3731

Available from your favourite dealer. If you have difficulty in obtaining it, contact the principal Aegis Agent in your State.

★ N.S.W.: WATKIN-WYNNE Pty. Ltd., 173 Pacific Highway, North Sydney.
★ QLD.: CHANDLERS Pty. Ltd., Cnr. Albert & Charlotte Sts., Brisbane.
★ S.A.: GEORGE PROCTER, 40 Pirie St., Aelaide.
★ W.A.: A. J. WYLE Pty. Ltd:, 1011 Hay St:, Perth;

LABORATORY & INDUSTRIAL POWER SUPPLIES



D.C. POWER SUPPLY
0-300 VOLTS—2 AMPS
CONTINUOUSLY VARIABLE

by

STABILAC

- ELECTRONIC A.C. VOLTAGE STABILISERS—200 V.A. TO 10 K. V. A.
- CONSTANT VOLTAGE TRANSFORMERS 60 & 120 V.A.
- D.C. POWER SUPPLIES TO ORDER.

STABILAC PTY. LTD.

49 YORK ST.,
SYDNEY. BX2298

With extra negative bias on the grid, supplied by the AVC system, the total drain is likely to be something below 10 milliamps for most of the time.

The 6BA6 can draw 15 odd milliamps as an RF IF amplifier, when operating under maximum gain conditions. However, its plate and screen current are entirely dependent on the AVC-controlled bias, which might easily run to twenty or thirty volts negative.

Since the tuner will normally be tuned to local stations, it is likely that the 6BA6 will run most of the time at half-current or less—in other words six or seven milliamps.

Coming to the 12AU7, we find that one-half of it is used purely as diode detector. Its plate is earthed and it draws no current whatever from the supply.

LOW DRAIN

The other half operates as a cathode follower with about 12,000 ohms in series with the supply and a 1500 ohm bias resistor. According to the curves (you'll have to take our word for this) the operating current will be about 5.0 milliamps.

Thus the total for the tuner will be near enough to 22 milliamps.

If we add this to the previous figure of 79.2, we get a grand total for the whole outfit of 101.2 milliamps. Under typical conditions, therefore, our suggested 125 milliamp transformer offers a near 20 pc margin of safety, over and above what the manufacturer may have allowed.

The same general reasoning will apply for the 2A3 amplifier, which our correspondent also mentions.

His 200-milliamp transformer must look quite impressive but I doubt whether it has done much to put him on "the safe side". There's even a chance that the extra volts resulting from a big lightly-loaded transformer may embarrass the output valves.

So much for that. The letter from R.M., "A Student's Worries", is in a very different category and raises a question which is new to these columns. In fact, I can't recollect having seen the subject discussed anywhere, except on a purely mathematical basis — and you'd hardly call it "discussion".

DISILLUSION

But first, R.M.'s opening paragraphs might well be entitled, "The Dawn of Disillusionment", or something to that effect. It's a mental process that most people go through as they grow older.

Maybe you can recall your first days at school, your sense of inferiority, the awe you felt in the presence of the headmaster, who knew everything about everything — and everybody.

Years later, as a prefect or something, you shook his hand as you said goodbye, conceding that he was a decent old cove, despite his obvious failings.

I remember my own early days in radio and the august people who sat behind glass doors marked "Manager", "Chief Engineer", and so on.

It took me quite a few years to realise that they were just ordinary human beings like myself, who made right and wrong decisions, forgot important things, got their facts mixed up and were stumped at times by technical problems.

Some of them even turned out to be fellows with a terrific "line" but only just enough real knowledge to get by.

Few, if any, were ultimate geniuses.

I'm afraid life's like that and you have to learn to accept it, realising that you yourself are part of the pattern.

KEEPING UP

To the hard-working student, facts, once assimilated, become sacred. He must retain them to pass examinations and he fondly imagines that he will retain them for ever, adding to his store of knowledge as the years go by.

How wrong can one be?

The whole field of radio and electronics is now so vast that no one person can hope to keep up with it all. Twenty years ago . . . yes . . . but not now. You don't even try.

Radio and its allied techniques have permeated into almost every branch of science.

The man who works at television is in a different world altogether from one who takes up medical electronics. Neither will know much about microwave and carrier communication, nor yet again of computing and radio control.

Even audio, these days, is a very specialised field, demanding a knowledge of music, acoustics, drama, &c, as well as mere electronic circuitry and devices.

The man who works with tools forgets his figures and vice versa. Bog him down with administrative duties and he'll forget both. I don't imagine that R.M. will be any exception when his turn comes.

A few years back I wrote a whole series of articles on television. When the subject came around, I had to dig out all the references I could find to color and, together with Phil Watson (our photographic genius) produce what I hoped would be a logical and readable summary of the whole subject.

If you asked me, at this moment, to repeat the substance of those articles, I couldn't, because I've forgotten it.

I'd have to go back and study my own articles!

Perhaps lecturers get the same way about topics outside their normal curriculum.

SIDEBANDS

However, I doubt that you want to read any more of such musings. R.M. has a problem which calls for attention and that is the more urgent. In fact, he had three, altogether, one of which he solved himself, and the other containing too much algebra to handle conveniently in these columns.

The remaining one, as set out in his letter, has to do with sidebands. Why don't the two sidebands beat together separately to produce an audio component having twice the frequency of the original modulation? An inherent second harmonic, in other words.

We tried this question out on several "victims" and not one of them could smile benignly and say, "Well, it's this way . . ." On the contrary, I couldn't find much evidence of them ever having thought much about it.

WRITER'S DEFINITION OF HI-FI

A reader from South Australia sends along a clipping from an overseas magazine, which contains this impression of high fidelity, on one of their leading feature writers:

THE latest craze is for high-fidelity phonographs and radios. But just what is high fidelity? I am glad you asked me. High fidelity is much higher than low fidelity, which, in turn, sounds better than infidelity or no fidelity at all.

The reproductive range of the average phonograph is incapable of emitting sounds above, say, 6000 cycles per second. On the other hand, a stirring flute may hit somewhere around 15,000. This means you lose the flute.

Actually about half the instruments in the orchestra and their overtones are lost when they are played on an instrument that has no high-fidelity equipment. Take, for example, Schneider's Symphony in D. In the last, or Presto, movement, the score calls for the drummer to hit the harpist over the head with a drumstick. In the concert hall this provokes a dull clunk. On poor reproducing equipment it produces nothing at all. On high fidelity it produces not only the clunk of the stick but the overtones of the vibrating noggin.

Modern music cannot really be appreciated until heard on the newer equipment. The score of Vlodkin's Dynamo Symphony, for example, calls for three dishpans — key of C — three heavy iron chains and a coffee grinder.

This Vlodkin symphony sounds simply horrible on poor equipment. It sounds horrible anyway, but that is beside the point. On good equipment you can really hear how horrible it sounds.

I shall never forget how impressed my wife was when I secured a diamond needle, a full-range speaker, and so on, and began playing my old records with this suverb new equipment. She came into the music room as I was listening blissfully, and said sheepishly, "Somebody dropped a soupspoon into your loudspeaker."

I think this illustrates what a difference good equipment makes.

CRYSTAL INSERTS

ZEPHYR

TO MEET THE AUSTRALIAN USERS' REQUIREMENTS

MODEL 1XA — with Zephyrfil Sintered Filter — Aluminium diaphragm—fully protected crystal.
60-6500cps—45db Grid 1—5 meg load.

MODEL 6XA — with protected aluminium diaphragm — patented crystal unit
70-7000cps—38db Grid 1—5 meg load.

MODEL 11XA — with Zephyrfil Sintered Filter — Aluminium diaphragm —
55-8000cps — 40db Grid 1—5 meg load.

ALL UNITS FITTED WITH REAR HUM SHIELDS

RETAIL PRICES
1XA 45/9 ea.
6XA 29/7 ea.
11XA 38/6 ea.

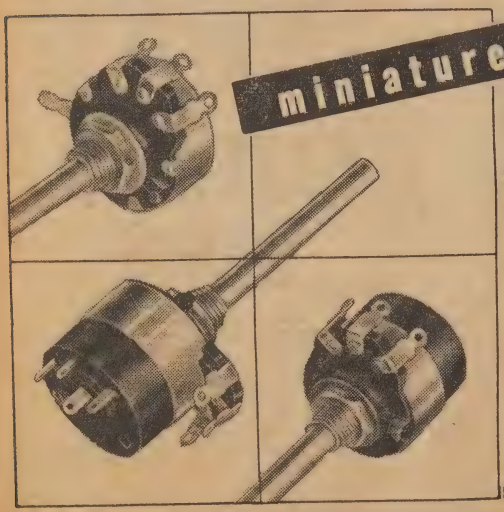
Stocked by leading wholesalers in each State

ZEPHYR PRODUCTS PTY.LTD.

PHONE BL1300

58 HIGH ST., GLEN IRIS, SE6, VIC.

MORGANITE



miniature POTENTIOMETERS

MADE IN AUSTRALIA

New in design, and fully incorporate the traditional Morganite standard of quality. Radio engineers will appreciate not only the small, compact size of the Morganite Type A Potentiometer, but also that it is available with a double pole switch of proved Morganite reliability. Over half of all radio and T.V. sets made in the British Isles use Morganite Type A Potentiometers.

SPECIFICATIONS:—

- Overall diameter 1-1/8in.
- Double pole Type V switch operated from shaft.
- New steel rotor for shielding and steel shaft for accuracy.
- DOUBLE CLENCH TERMINALS eliminate noisy joints.
- Same track design for switch and non-switch type enables interchangeability.
- The renowned MORGANITE RESISTOR TRACK, low noise, hard wearing, wide range of standard resistance values and gradings.
- Rating ¼-watt is very conservative allowing for trouble-free occasional overload.
- Stability of track under 3% resistance change after 800,000 cycles on load.
- Standard position fixed tapping available.
- Improved slider design in special non-tarnishing metal maintains correct pressure for minimum noise without wear.
- The type V switch can be relied upon to handle 2 amps. 240 volts or 12 amps 12 volts D.C. for 30,000 operations at least, and is the only one used by leading U.K. manufacturers.
- Instrument QUALITY at LOW prices.

THE MORGAN CRUCIBLE CO.
(AUSTRALIA) PTY. LTD.

HEAD OFFICE:
65-67 BOURKE ROAD, ALEXANDRIA, N.S.W.
PHONE: MU1371. TELEGRAMS: "MORGANITE," SYDNEY

272 CITY ROAD, SOUTH MELBOURNE, VICTORIA
PHONE: MX6106. TELEGRAMS: "CRUCIBLE," MELB.

They'd simply assumed (rightly enough) that a detector extracts from the carrier what the modulator put in and left it at that. Perhaps you can't blame them, because the answer to R.M.'s question won't be found in many textbooks.

In point of fact, the frequencies do intermodulate in the way R.M. has suggested, though it does not follow that each individual product must have a separate and significant value.

The important quantity is the sum of these individual products.

To complicate matters further, it must be realised that harmonics of the input frequencies may appear in the detector output and that these can intermodulate to produce further resultants, in or out of phase with the others.

What the final output of the detector will be, cannot possibly be resolved by such wordy speculation. We can only accept the findings of those who can equate all the components mathematically to produce a single answer.

And their verdict is quite clear.

LINEAR DETECTORS

By a rather lengthy process, they show that the magnitude of the harmonic components gradually diminishes to zero as the characteristics of the detector approach the ideal.

Therefore, assuming such an ideal detector and no distortion elsewhere in the system, the resultant is an audio signal identical with the original modulation.

An "ideal" or "linear" detector is visualised as one which has no region of curvature between its conductive and non-conductive state. Its characteristic is simply a straight line which rises abruptly from zero reference. It has never been achieved in practice.

In all practical detectors, there is a distinct region of curvature and the input/output line is not truly straight. Low audio distortion can therefore only be achieved:—

(1) By obtaining the best possible detector characteristic, and

(2) Applying to the detector a high signal input so that the region of curvature is small compared with the total amplitude of signal.

By such means it is possible (we hope) to reduce the detector distortion to a figure which is below the general level of distortion elsewhere in the system. But, of course, this is a controverisal statement, because there is no universal agreement yet as to the minimum increments of distortion it is worth chasing in a reproducing system.

PLAYING CHESS

Just by way of a little light reading to round things off, I must acknowledge a note from a reader, K.H., in Victoria. He takes me to task about a recent reference to the futility of playing chess by radio.

"Perhaps you've never played chess," he says.

As a matter of fact, I haven't. I'm not old enough yet.

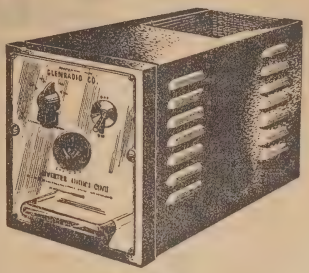
Then there's a letter to hand from a Queensland reader. He joins the ranks of those who have "invented" a particular form of electrical perpetual motion.

Just in case you think I am being nasty, let me confess that I "invented" it myself in younger days.

The reader's letter? Turn back to page sixty-five.

INVERTERS for every PURPOSE

240 VOLT AC 50 CYCLE INVERTERS



Excellent frequency stability. Radio interference suppressed.

Surge suppressors fitted to every unit! Available for use with radio amplifiers, tape recorders, synchronous motors, radiograms, etc..

Packed weight approx. 30lb.

Size 11in x 6in x 7¼in

Special models with different voltage input and output load manufactured on application.

Please add freight on all orders

TRADE ENQUIRIES INVITED

NOTE NEW PRICE LIST

INPUT VOLTS D.C.	OUTPUT W AT 240V	PRICE RETAIL
12	100 watts 50cycle	£30/12/-
32		
240		

Prices of higher wattage inverters on application

GLENRADIO COMPANY

4 Renwick Street, Leichhardt, Sydney. LM4545

UNISELECT CONTROL SUPERSEDES PUSH BUTTONS

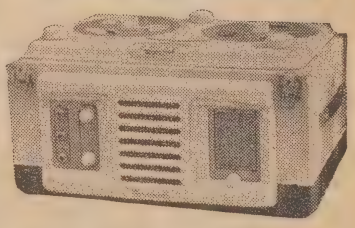
INSTANT SPEED SWITCHING

COMPLETE STABILITY, RELIABILITY, AND WONDERFUL FIDELITY

NO WOW! NO FLUTTER!

STREAMLINED GLAMOUR

Ferry



EXTENDED RANGE

TAPE RECORDERS

EP7-R (with radio)
EP7 (without radio)
Four Hours of wonderful music!
Speeds: 1 7/8 & 3¾ IPS. Twin-track.
Two hours of wide range!

SP7-R (with radio)
SP7 (without radio)
Two hours of wide range!
Speeds: 3¾ & 7½ IPS. Twin-track.
One hour of super fidelity!

S.A.: FERRY SOUND INDUSTRIES, 99 Springbank Road, Clapham—UM 1850
N.S.W.: FERRY SOUND INDUSTRIES, 175 Woodland St., Balgowlah—XJ 1856
VIC.: TOPLINE RECORDING SERVICE, 5 Buckley Street, Noble Park—UM9402
W.A.: SUBURBAN RADIO CO., 334 Charles Street, Nth. Perth—BA2395

SURPLUS

512 Elizabeth St., Melbourne, C.1.

'Phone: FJ5904. Just 4 doors

Mail Orders Carefully packed

Please add Freight or Postage

SPECIAL DISPOSALS METER OFFER

0-1 amp meters, AC-DC, 2½in dial, 45/-

0/1 milliamp, 2½in dial .. 37/6

Weston 0-50 volt 0-100 amps combined M/coil, £3/10/-

English 50-0-50 Ammeters, M/Coil 37/6

English 0-50 Ammeters, AC-DC .. 42/-

English 0-40 Voltmeters, M/Coil .. 25/-

English 0-300 AC-DC Voltmeters .. 55/-

English 0-5 Milliammeters, 2½in .. 27/6

English 0-25 Ammeters, 2½in M/c .. 30/-

English 0-10 Ammeters, 2½in dial, Moving Coil 45/-

English 0-30 Voltmeters, 2½in dial, AC-DC 42/-

English 0-40 Ammeters, 2½in dial, AC-DC 42/-

English 0-30 Ammeters, 2½in dial, AC-DC 45/-

English 0-150 Voltmeter, 3in dial, Moving Coil 39/6

Eng. 0-500 Micro Ammeter, M/Coil 37/6

Eng. 0-20 amps, 2in dial, M/c. .. 25/-

Eng. 0-1½ Milliamps, 2in dial, M/c. 19/6

Eng. 0-20 Milliamps, 2½in dial, AC-DC 17/6

Eng. 20-0-20 Ammeter, M/Coil .. 37/6

Eng. 0-30 Amps AC-DC 2½in dial 42/-

Eng. 0-50 Amps AC-DC 3½in dial 75/-

Eng. 0-60 Amps AC-DC 3½in dial 75/-

Eng. 0-80 Amps AC-DC 3½in dial 75/-

Eng. 0-1 Amps DC 2½in dial 35/-

Eng. 0-5 Amps AC-DC 2½in dial .. 45/-

Eng. 200 Amps AC-DC 3½in .. £4/19/6

WATCHMAKERS AND INSTRUMENT MAKERS

English Tweezers .. .. .. 6/6 and 5/6

Eyeglasses .. .. 6/6 and 8/6

Extra strong double lens Eyeglasses 15/-

Screwdrivers, set of five 13/9

MOTORISTS' CLIP ON TROUBLE LIGHT MAGNIFIED BULLSEYE LENS

6 Volt 7/6, 12 Volt 6/6.

Complete with flex and plug.

R.A.F. LEATHER FLYING HELMETS, 35/- each

Intercommunication Tubes 50/-.

PHONES 12/6.

Polaroid Goggles, 48/6.

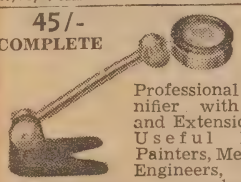
MK7 Goggles, 37/6 Pair.

MK8 Goggles, 48/6.

WOOL LINED FLYING BOOTS, £5/15/- pr.

Genuine RAAF outer Waterproof Suits, £7/15/-. All sizes.

45/- COMPLETE



Professional Magnifier with Stand and Extension Arm. Useful Doctors, Painters, Mechanics, Engineers, Photographers.

ARMY FOCUSING TELESCOPE

Easily converted for use on dumpy levels. Can be used as a rifle sight. Excellent magnification .. £4/19/6

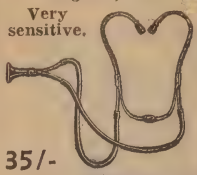
Fitted with cross hair.

ADJUSTABLE FOCUS

MECHANICS' STETHOSCOPES

Ideal for Testing Engines, etc.

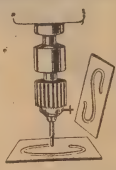
Very sensitive.



35/-

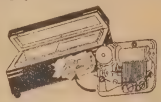
ROUTER BITS

Ex-Munitions Cost 18/6 Our Price 10/- each.



Can be used on Metal or Wood.

Now you can make your own music box with these Swiss music units. They can be fitted to any type of box, doll, jug, teddy bears, etc. Hours of enjoyment for all the family.



30/- EACH

Tunes available: Lili Marlene, Jingle Bells, Blue Danube, Harry Lime Theme, Wedding March, The Merry Widow, Happy Birthday, Annie Laurie, How Dry We Are, Roll Out The Barrel, Silent Night, Teddy Bears' Picnic.

Replace those broken side curtains with cellulose acetate which takes the place of celluloid and lasts four times longer. Will not discolor.

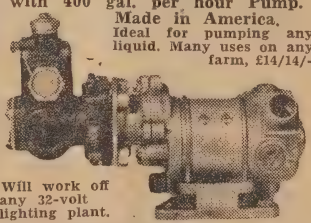
32/6 SHEET

Non-inflammable acetate sheet is recommended for all types of side curtains. Sheets are 20 thousandths of 1 inch thick. Size of sheet, 24in x 52in. Can be sewn or cemented into frames.

Aircraft 24 volt Motor complete with 400 gal. per hour Pump.

Made in America.

Ideal for pumping any liquid. Many uses on any farm, £14/14/-



Will work off any 32-volt lighting plant.

Pump only, 55/-.

ELECTRIC ENGRAVER

What everybody has been waiting for. An Electric Engraver that works off your car battery.

Ideal for name tags, dog collars, plant labels, etc.

Engraves anything in metal.

29/6

Engrave your name on all your tools. Marked tools are never stolen. No garage should be without one.

24-VOLT MOTOR COMPLETE With Fuel Pump

Ideal for Caravans. Takes the place of Hand Pumps.

£5 each.

Many uses on the Farm. Will Transfer Petrol or any Liquid from Drums, etc. Will work from 24 or 32 volts AC or DC.

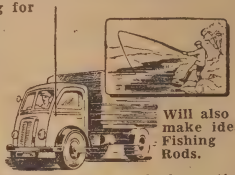
SPECIAL OFFER AIR FORCE PLOTTING BOARD

IDEAL FOR USE AS STUDENTS DRAWING BOARDS COMPLETE WITH DRAWING ARM

25/- EACH

STEEL ARMY TANK AERIAL RODS, WILL MAKE IDEAL RADIO AERIALS FOR CARS OR TRUCKS.

Too long for postage. Advise nearest railway station.



Bases to suit Aerials, 12/6 each.

Will also make ideal Fishing Rods.

12ft long, 3 sections. Each section 4ft, 22/6. 8ft long, 2 sections, 15/-.

Brand new American Wobble Pump, semi-rotary

PHOSPHOR BRONZE VANES

Continuous flow, £3/19/6.

Ideal for caravans, empyting or filling petrol tans, watertanks, etc.

BALL AND SOCKET INSPECTION MIRRORS

8/9

Ideal for mechanics, radio repairs.

AMERICAN VACUUM or AIR PUMP

Builds up air pressure to 20lb at 1000 R.P.M. develops up to 120lb of hydraulic pressure; will pump 7½ gallons S.A.E. oil or other liquids per minute. Useful for spraying, milking, presses, oil burners, hydraulic systems, £3/10/-.

STORES

512 Elizabeth St., Melbourne, C.1.
from Victoria Street. 'Phone FJ5904
and Efficiently Despatched
Include State in Address

Stock and Die Sets, ½in, ¾in, and 1in water pipe, **£4/19/6.**

IN FIRST-CLASS ORDER DALTON COMPUTERS IDEAL FOR AERO CLUB, 45/-

230 volt AC. NEON TESTERS, 4/6.

6 volt 70/-
12 volt 76/-
Complete with flex and switch.

At last the spot light you have been waiting for

Fitted with genuine American sealed beam globes. No motorist or boat owner should be without one.

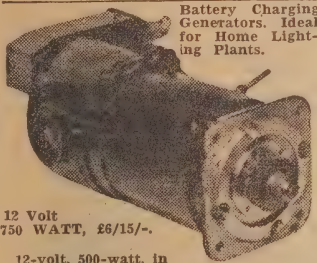
Ideal for Fox or Rabbit Shooting.

ENGLISH ARMY SPOTLIGHTS

IDEAL FOR SHOOTING. FIT ONE TO YOUR CAR.

Fitted with Mirror Reflector.
6-volt **37/6.** 12-volt **25/-**

Battery Charging Generators. Ideal for Home Lighting Plants.

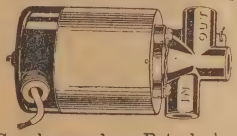


12 Volt 750 WATT, £6/15/-.

12-volt, 500-watt, in good working order £5
12-volt, 500-watt, new £7/10/-
24-volt, 1000-watt, Brand new .. £8/10/-
200 amp Generator. Ideal for welding. Made in America.
Brand new £50
Tested and in perfect order £35

LIQUID SHUT OFF VALVES

Will work off 12 or 24 Volt, ideal for Water or Alcohol Injectors.



50/-

Can be used as Petrol shut off for car protection. Many factory uses.

ARMY SPOTTING TELESCOPES

Many uses on the farm. Ideal for Sheep Spotting.

Useful on the rifle range, 3 draw 17in long, 6½in closed, 1in object lens, 18 magnification. Made in England **£7/19/6**

BRAND NEW LEVER TYPE GREASE GUNS WORTH £4/19/6

59/6

Ideal for all types of Trucks, Tractors or Cars. 7500lb pressure.

ARMY FLUTES

39/6

Ideal for School Bands.
Never before at this amazing price.

COMPLETE BATTERY CHARGER

Fitted with Brand New English Selenium Rectifier.

Works off 230v. Household Supply.

Charges any battery, 6 volts at 4 amps, £6/15/- complete. Also available, 6 or 12 volt Charger combined. Charge 2 amps £7/15/-. Brand new 6 volt, 2 amp. Charger, complete, £5/2/6.

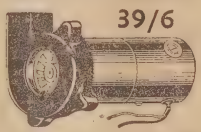
Brand new AEROPLANE WHEELS

IDEAL FOR WHEELBARROWS, HAND TRUCKS, TRAILERS, etc.

10½in x 4½in, £4/15/-, complete with tube.

English Motor and Blower, 24 volts.

Will work off any Lighting Plant.



39/6

Large size also available that will work off 12 or 24 volts, £3/15/-.

Not Secondhand.

BRAND NEW ENGLISH G.E.C. RECTIFIERS

Make yourself a Battery Charger.
12 v. 2 amp. 32/6
6v. 6 amp. 49/6
12v. 3 amp. 45/-
6v. 2 amp. 24/6
6v. 4 amp. 45/-
12v. 5 amp. 79/6

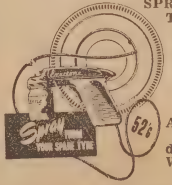
Transformers to suit above Rectifiers, 2 amp, 37/6; 6 volt, 5 amp, 45/-; 12 volt, 5 amp, 55/-.

SPECIAL! SPECIAL!
Just Arrived Sportsmen's BINOCULARS
EXCELLENT QUALITY. Pair 39/6

SPECIAL OFFERS

American Schrader tyre pumps, work from your spark plugs, **39/6**. Good quality fountain pens with visible filler, **5/6.** Car type fire extinguisher. Every car should carry one. Cost **£7/10/-, £4/10/-.** Canvas car tool rolls, **8/6.** American long blade jungle knives, complete with sheath, **15/-.** Large size white handkerchiefs, **1/6** each. 4½in saw blades, complete with arbor, ideal for making saw bench with electric drill, **25/-.** 6ft wide waterproof canvas, **15/-** yd. Bell-ringing generators, ideal for telephones, **25/-.** German Army marching compasses, work similar to prismatic, **29/6.** 110 volt 1000 watt prosector globes, **32/6,** 24 or 32 volt fractional HP electric motors, make ideal grinder mixers, etc., **50/-** Small 12 or 24 volt hobby motors, **39/6.** ¼in Black and Decker 230 volt electric drills, **£11/15/3.** ½in **£24/8/3.** Fish pond aerators, work from 230 volts, **57/6.** All Steel Mechanics' Tool Boxes, **19/6.** Magnifying Glasses, 8 mags., **8/6.** 10 magnifications, **12/6.** Metal Drill sets, 1-16 to 3-16, 9 Drills for **3/6.** 24 volt motor and hydraulic pump, capacity 3½gals per minute, **£3/15/-.** New headphones suitable for crystal sets, **17/6** pair. New Army Mosquito nets, ideal camping, **25/-.** Genuine RAAF Berets, **10/6.** Surveyors' Abney levels. New price, **£18/18/-, £7/10/-.** Army paint, oil base, blue, **25/-** gal. Brand new American Cutting and welding torches, **£4/4/-,** complete. Army Slouch Hats in good order, **15/-.** Generator Test Meters, 35-0-35 am meter, 4½in dial, **45/-** 0-10 volt meters, 4½in dial, **45/-.** Loading Resistors can be supplied to make meter read 10.20 at **12/6.** Medical Scalpels, many uses, photographers, etc., **6/6.** Shaded Pole induction Motors made by Hoover of England, 230 volts, A.C. Ideal for Projectors, Tape Recorders, Fans, etc., **£4/19/6.** SAE open end Spanners, 6 to set, **24/6.** Whitworth, 4 to set, **18/6.** RAF Frogmans swimming fins, adjustable straps, 1 to 5, **19/11;** 6 to 10, **24/6.** Brand new 7-8in Spark Plugs, suit most old type cars, **2/6** ea. Tapped Transformers, 6, 12, 18 and 24 volts, 3 amps, **39/6.** 230 volts input Army Steel Tow Ropes with looped ends. **17/6.** SAE or Whitworth Spanner sets. Open one end, ring the other 6 spanners to set, **23/6.**

SPRAY YOUR CAR, TOYS, HOBBIES, FURNITURE



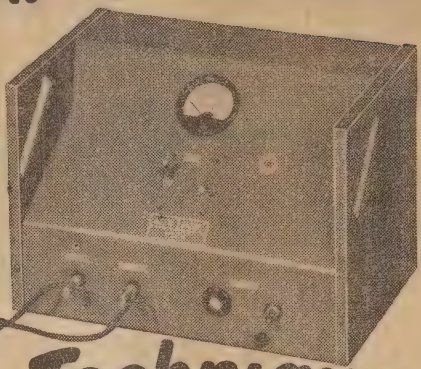
52/6
Spray from your Spare Tyre.

An Ideal Tool for touching up damaged paintwork Will spray Lacquer, Paint, Enamel.

Approved and used by

T.A.A.

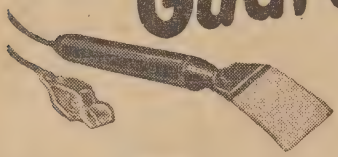
for replating and maintaining a protective zinc coating on propellers which are plated while assembled.



New Plating Technique Guarantees-

fast . . . efficient and reliable Plating!

The Scope technique brings the plating tool to the job and the electrolyte is deposited by moving the plating tool in a brisk, circular motion over the surface of the work. This easily acquired technique is fast, efficient, reliable and replaces bath plating particularly where plating in situ is required to save dismantling and re-assembling costs. Deposits are non - porous, hard and bright. Cost is £23/18/- plus 12½ pc Sales Tax.



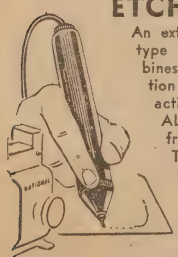
Offers many indisputable advantages —

1. Deposits nickel, copper, tin, zinc, cadmium, silver and gold on prepared metal surfaces where they stand.
2. Partially plating articles as in selective case hardening. Small parts like screws.
3. Silver plating of light reflectors, electrical contact surfaces, including busbars.
4. Make good damage due to wear and corrosion.
5. Salvage faulty plating.
6. Objects too heavy and bulky for the plating bath.

SCOPE

Portable INDUSTRIAL ELECTROPLATING UNIT

VIBROSCOPE ETCHING TOOL



An extremely efficient, new type etching tool. Combines mechanical vibration with electrical action. Indelibly marks ALL metals. Operates from Scope's Iron Transformers or AC/DC sources between 3 & 4 volts. Retail Price, 35/-

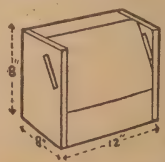
New Tungsten replacement part, 4/10.

SCOPE SOLDERING IRON

The standard soldering iron for all radio, electrical, instrument and light sheet-metal work. Heats in SIX SECONDS. Scope is speedy, efficient, and its effectiveness is equivalent to a 150W. iron. Operates from A.C. mains with National Transformer optionally supplied or from a car battery. Retail price: Iron 50/-. Transformer, 47/11.

SCOPE INSTRUMENT BOX

Ideal for use in the construction of battery chargers, multimeters, VTVM's oscillators, bridges, portable amplifiers, inter-com's, L.T. or H.T. power supplies and laboratory instruments. Solidly constructed from sheetmetal, adequately ventilated, grey hammerstone finished. Used in the B.B.C. Price 37/6, plus 12½ pc Sales Tax.



Please forward "Scope" leaflet.

Name .....

Address .....

Supplier (Optional) ..... Jan.

Australian & Overseas Agents:

WM. J. McLELLAN & CO. PTY. LTD.

126 Sussex St. (just North of King St.) Sydney. BX 7131

MANUFACTURED BY SCOPE LABORATORIES, MELBOURNE, VICTORIA

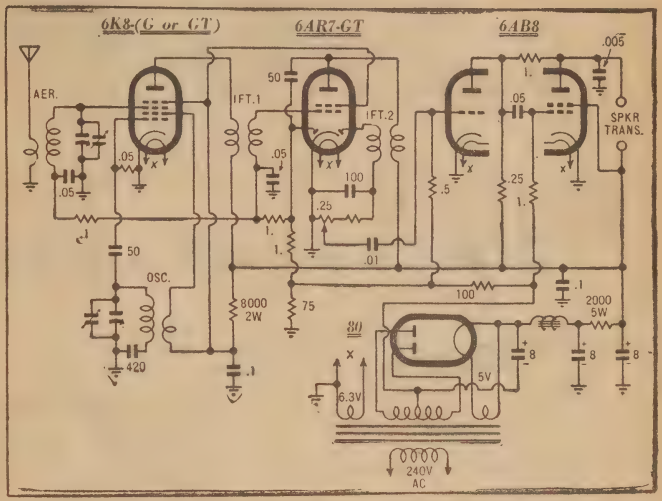
AVAILABLE AT ALL LEADING ELECTRICAL SUPPLIERS

A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

A 3/4 MANTEL SUPERHET. WITH DUAL AUDIO VALVE

Here is an interesting circuit for a mantel set submitted by a reader from Guildford, NSW. It employs a combination triode power output pentode valve in the audio section to approach the performance of a conventional 4/5 valve design.



OUR contributor is Mr. R. Howard, of 111 Guildford Rd., Guildford, NSW.

He claims that without any aerial connected to the set, he can receive all local stations with more than sufficient volume, while at night many country and interstate stations can be received. With some four or five feet of aerial, he can tune several distant stations during the day.

The converter stage employs a 6K8 probably because that valve happened to be on hand. Obviously other converter valves would be quite satisfactory for broadcast band use but if you change to another type, you may well require a change in the value of the 8000 ohm voltage dropping resistor feeding the converter oscillator anode, screen and IF valve screen.

The IF stage wiring follows conventional lines. The 1 megohm AVC diode load resistor returns to the back-bias network to bias the converter and IF valves through the AVC line.

An RF filter is included between the IFT2 and the volume control although it is quite possible that the increase of the detector diode RF return from 100 pf to 250 pf and the omission of the .1 megohm resistor and the second 100 pf capacitor would be permissible.

The 6AB8 is also known by its European type number of ECL80. It operates at an anode and screen voltage of 200 volts to give an output of about 1.4 watts into a optimum load impedance of 11,000 ohms. Anything between 10,000 ohms and 15,000 ohms would be quite satisfactory in the circumstances.

Although our contributor did not mention the power transformer ratings, we deduced that it would be of 225 volts a side at 50 mA, although the set would actually draw only about 40 mA at "no signal" condition.

A high tension of around 200 volts is obtained by adding a resistance-capacitance section to the filter. The value of 2000 ohms here seems a little high but we feel that if interested readers have access to a multimeter, this value could be adjusted to give the appropriate HT voltage.

It would probably be necessary to use an indirectly heated rectifier instead of the 80, such as the 6X5 or 6V4 because transformers of this size do not usually have a 5v winding. Alternatively, a larger transformer could be used if you happen to have it on hand, and the HT adjusted to its correct valve by means of a series resistor.

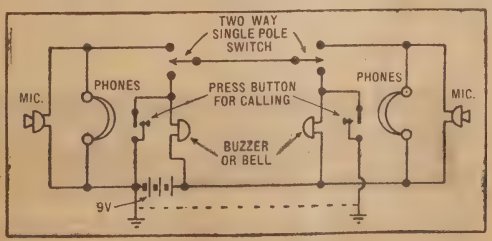
A 2-STATION INTERCOMM. UNIT

THIS simple arrangement for intercommunication between two points was submitted by T. I. Mills, of The Scots College, Bellevue Hill, NSW. It could be constructed for a rather small financial outlay, particularly if items from disposals sources, or the home constructor's "junk box" are used.

Fundamentally, it consists of a carbon microphone and headphones connected in parallel at each end of a two-wire line with a 9-volt battery in series with one line. With the aid of switches, a calling circuit can be brought into operation using a buzzer, bell or light to attract attention. A disposals telephone handset could replace the microphone/headphones combination if more suitable.

With this simple arrangement of the calling circuit, it will be necessary to have a rigid procedure whereby the two-position switch is always left in the "call" position after a conversation is completed to await any future call.

We have modified our contributor's circuit slightly to reduce the number of batteries from three down to one. This involved the use of a third line or the use of the earth as a return circuit, for which purpose a good earth connection would be required at each end.



NEW

NEW

MAGNETON TAPE FS.

TECHNICAL DATA

SENSITIVITY: The Agfa Magneton Tape FS for tape speeds of 19 and 9.5 cm/sec. ($7\frac{1}{2}$in and $3\frac{1}{2}$in/sec) has a sensitivity of plus 14 plus/minus 1 db for 1 kc/s, measured at 76.2 cm/sec, optimum premagnetization and related to the standard broadcasting tape (plus/minus 0 db).

FREQUENCY RESPONSE: The Agfa Magneton Tape FS has a frequency response of at least plus 5 db.

DISTORTION FACTOR: The distortion factor is lower than 0.5 per cent, measured as proportion of the 3rd harmonic (3 kc/s) of 1 kc/s. Thus the low distortion factor of the "FS" Tape ensures a particularly good and undistorted reproduction.

MODULATION NOISE: 30 db.

Available from Distributors and Dealers throughout Australia

SOLE IMPORTERS: HENRY H. YORK & CO. PTY. LTD., MELBOURNE — SYDNEY

TRADE REVIEWS AND RELEASES

From H. N. Chapman Company, 31 Macquarie Place Sydney, we have recently received technical data for, and a sample of, the well-known BASF Magnetophon recording tape. This data should be of particular interest to tape enthusiasts who are continually seeking quality performance.

THESE new tapes will be available on a very wide range of spools measuring from 2in to 10½in in diameter. The spool in most usage which has a diameter of 7in, will contain 1750ft of tape instead of 1200ft and will give a total playing time of 46 minutes at a speed of 7½in per second, or 92 minutes at 3¾in per second single track.

On double track machines such as are in wide usage throughout Australia, the new Magnetophon type LGS long-playing tape will give three hours of recording at 3¾in per second. The Magnetophon LGS series of tapes are on a polyvinyl chloride base and have unusual strength. The following are the statistics of the Magnetophon type LGS tape as issued by Badische Anilin and Soda Fabrik in Germany.

Mechanical Data

Property	LGS
Tensile strength per tape	2.3 kg
Elastic elongation*	0.8-1.2%
Plastic elongation	0.04%

*At 1 kg load per tape.

Some Electro-Magnetic Data

Property	LGS
Erasure	70 db.
Distortion (at 1.55 mV playback EMK)	40 db.
Printing	56 db.

Magnetophon Tape BASF Type LGS, owing to its greatly increased sensitivity, also at high frequencies, is particularly suitable for sound recorders with a low tape speed, eg, 19 cm/second (7½in/second). The sensitivity at 1000 cycles p.s. is higher by 12+or−2 decibels than that of the standard tape (=0 decibel) of the German Radio. The frequency reproduction up to 10,000 cycles is 3−5 decibels higher compared to 1000 cycles (measured by standards of German Radio).

Magnetophon recording tapes are distributed throughout Australia by H. N. Chapman & Company, Kyle House, 31 Macquarie Place, Sydney.

A packet of the BASF Magnetophon tape. The various grades available should interest both amateurs and professionals.

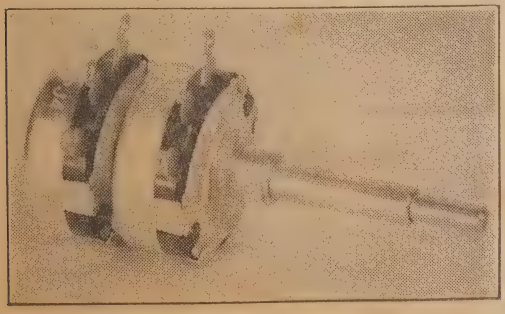
IRC RELEASES DUAL POTENTIOMETER

A recent release from W. J. McLellan & Co. is a dual potentiometer with a separate drive for each unit. Such a unit is particularly useful where the cabinet design limits the number of control positions, since a pair of concentric knobs may serve both volume and tone.

THE drive is in the form of a concertina shaft, the inner spindle controlling the rear section and the other one the front section. The inner shaft is .187in diameter and the outer one .265in.

The units are available in any combination of normally available carbon potentiometer values and also in both logarithmic and linear tapers. Combinations of carbon and wire wound types are also available, but with the restriction that the wire wound unit can only be accommodated on the rear position.

The rear section may also have a switch fitted, while the shafts may have flats or screwdriver slots fitted to special order.



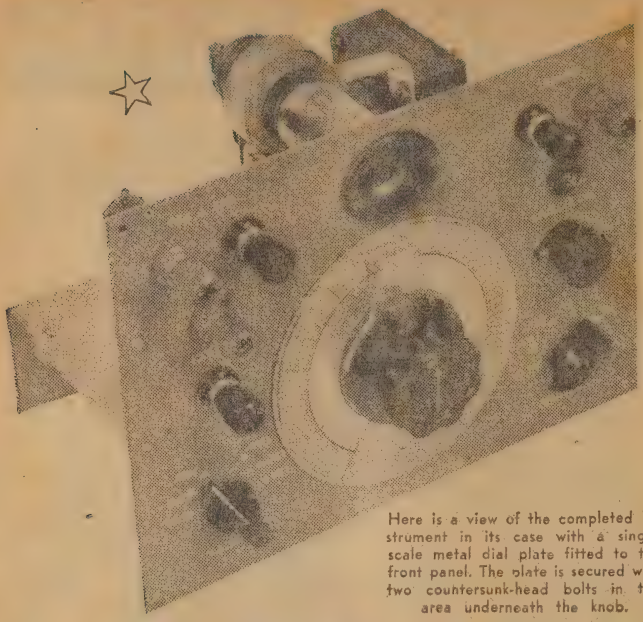
This new concentric shaft potentiometer assembly will find many applications in the radio industry. It is available in a large number of combinations, including a switch on the rear unit.

Tape Exchange Clubs

TAPE exchange clubs are flourishing all over the world. Their members correspond with each other by means of tape instead of letters — a much more flexible method of getting to know each other.

The Australian Tape Recordists Association, whose headquarters are in Victoria may be reached via Box 36, PO Noble Park, and there are branches in the various States.

You can make your tape recorder bring you new friends by this modern method of contact.



Here is a view of the completed instrument in its case with a single scale metal dial plate fitted to the front panel. The plate is secured with two countersunk-head bolts in the area underneath the knob.

CALIBRATING THE R/C BRIDGE

Last month we described our Standard R/C Bridge in its new dress. This month, in dealing with the actual calibration of the instruments, we present also an alternative method of mounting of the standard resistors and capacitors which enables a single calibration scale to serve for both resistance and capacitance measurements.

by Raymond Howe

AS mentioned in last month's issue, calibration of this instrument is effected by placing known values of resistance across the "Res and Cap" terminals, bringing the bridge into "balance" with the ratio control and marking the position of the ratio control pointer on the dial card.

Bridge "balance" is indicated when the tuning indicator "eye" is fully open.

Following calibration, unknown values of resistance or capacitance are determined by multiplying the value of the standard component to which the range switch is set by the "balance" reading on the ratio control dial.

RANGE MULTIPLIER

The standards for both resistance and capacitance measurement are related by a factor of 100 to the next higher range. For instance, a resistance value of 5000 ohms would show on the "100 ohm" range as a ratio of 50, while on the ".01 meg." range, it would show as a ratio of .5.

Similarly, a capacitor value of .005 mfd would show a ratio of 50 on the "100 pf" range and a ratio of .5 on the ".01 mfd" range.

Because of this range relationship, calibration points obtained with any one resistance range will apply equally well to the others.

Direct calibration for capacitance measurement is not necessary. The point is that the bridge is supplied from an AC source and capacitance measurements are made by comparing the reactance of the unknown capacitor with that of the standard capacitor.

However, as capacitive reactance is inversely proportional to capacitance value, the reactance ratio with the standard will normally read in reverse direction to that for resistance measurements. In actual fact, the capacitance scale will bear a reciprocal relationship to the resistance scale.

USE OF RECIPROCALS

Thus, for the instrument as described in last month's issue, calibration is carried out on the resistance ranges and a second scale inserted simply by drawing in the reciprocals of the resistance scale at appropriate points.

Most will agree, however, that the fewer the scales on any instrument, the better. Admittedly, in the case of the R/C bridge, the use of separate scales for resistance and capacitance measurement does not introduce much difficulty. By the same token, any steps to reduce this total to one scale must be for the better.

As mentioned in last month's issue, this can be achieved at the expense of a little more complication in the switching of the standard components.

The idea is to change over the standard component and the "Res and Cap" terminals in the bridge arms when going from resistance measurement to capacitance measurement.

EXTERNAL STANDARD

If the provision for "external standard" was omitted, the existing single bank switch would do the job, provided that separate terminals were used for resistance and capacitance measurement, that is, a common terminal and two others.

However, there is sufficient reason for the inclusion of the "external standard" facility and, besides, a 2-bank switch does not cost a great deal more than a single bank type. Accordingly, we are showing the modified circuit diagram employing this type of switch.

Also, you will see from the underchassis photograph, how the switch is fitted into place and how the components are rearranged. The wiring other than that for the bridge circuit remains undisturbed.

A cut-out was made in the chassis to give clearance for the larger range switch and ease of wiring to the terminals above it on the front panel. This will be shown on the chassis blueprint for this unit so that either system of switching may be used.

We suggest that before you mount the switch, you dismantle it and carefully punch flat the small raised stop on the inside of the clicker plate. It is much more convenient in this case to have a switch control which can be fully rotated in either direction without coming against a

a negative potential on the grid, hence the grid may be considered negative with respect to the cathode.

Another well-known arrangement is to make use of the total current drain of a receiver or amplifier by connecting a resistor in the negative return of the power supply, that is, between the centre tap of the power transformer and earth.

The resultant voltage drop across this resistor makes the centre tap negative with respect to earth and, if the grid is returned to the centre tap while the cathode is returned to earth, the grid is effectively biased by that voltage drop.

In a few special cases, notably oscillators and the amplifying circuits in transmitters, the grid may have such a large signal applied to it that it becomes positive and draws current during part of the signal input cycle.

By placing a resistor and bypass in the grid return circuit the voltage developed by the grid current bursts, charges the capacitor to an average figure and this becomes, in effect, a self-generated grid bias.

FEEDBACK

"Feedback" is the condition which arises when energy is fed back from the output to the input of an amplifier. The feedback may be positive or negative, depending on whether it adds to or subtracts from the normal input signal.

When positive feedback exceeds a certain value oscillation takes place, and this is the principle applied in the design of most oscillators.

Negative feedback on the other hand is useful in reducing most forms of distortion, and, when used discreetly, it helps to stabilise amplifiers.

★ ★ ★

What is a phase-splitter circuit?

The phase splitter is generally a stage comprising of a valve and its associate components, designed to produce two balanced out-of-phase voltages from a single signal voltage applied to its grid.

The circuit of a standard phase splitter and its relationship to a push-pull output stage is reproduced. Referring to this, the action is not difficult to follow. The normal resistance load for the valve is divided into two separate load resistors, one in the plate circuit, the other in the cathode circuit.

The plate current of the valve passes through both resistors and sets up voltage differences across them. The cathode will be at a considerable positive voltage above earth, and the plate at a still higher one.

Any change in plate current caused by an increase or decrease of an incoming signal will increase or decrease the voltage drop across each of the resistors.

An increase in the voltage drops will cause the cathode to become more positive, while the plate becomes less positive. This will constitute a negative-going and positive-going signal at the plate and cathode respectively.

A decrease in the voltage drops will cause the cathode to become less positive while the plate becomes more positive and the signals appearing at the plate and cathode will reverse their directions.

Because of this tendency for the plate and cathode signal voltages to move in the opposite directions with variations of the input signal, a balanced out-of-phase output is available to drive a push-pull stage.

I was wondering if you could suggest a publication on valves, explaining their function, type and comparing them electrically, thus providing a list of alternative valves which will do the same job. For example, I replaced (by means of an adaptor socket) an old 22A in an old battery superhet with a 1L5-G and the same results were obtained as using the old valve. A publication listing such alternatives would be invaluable.

Most of the valve companies could help you with the type of information you need. Many of their publications are available either free or at very low cost. Valve data books often contain a list of equivalent types in addition to the characteristics of different valves which would save you turning over the pages in order to find the equivalent to a particular type.

There have been valve books published which attempt to list all the valve types ever manufactured. Even with only very brief data and no curves a very thick volume is needed. Most local valve books list only types which are, or have been, popular in this country and, therefore, a much more modest volume will suffice.

Many valve types are similar except for one characteristic such as the base, the filament voltage or the shape of the envelope. A well-known example is the 2A5, 42, 6F6, 6F6-G family. The 2A5 is an output pentode with a 2.5 volt filament. The 42 has the same electrode structure but the filament is rated at 6.3 volts. The 6F6-G has the same electrode structure, bulb and filament voltage as the 42 but is fitted with an octal rather than the older style 6-pin base. The 6F6 has the same features as the 6F6-G except for a small metal instead of a glass envelope.

★ ★ ★

With regard to your printed circuits, what significance does an arrow with a cross at the end of it have? Also by what means may I use say a 5,000 ohm speaker in a circuit designed for a 7,000 ohm speaker? Would it be possible to reverse this and use a 7,000 ohm speaker in a circuit designed for a 5,000 ohm speaker. Also could a 0.5 meg. potentiometer be wired to do the job of a 1 meg. pot?

You certainly have a thirst for knowledge, Tom, but perhaps we can answer the last of your questions without too much trouble.

The arrow with the cross probably refers to our filament circuits where we usually do not draw the full wiring from the power transformer to the filament of each valve as it is usually sufficiently clear what is required and the extra lines would only confuse the drawing.

Some pieces of equipment have a number of filaments connected to one transformer winding and a number to another winding. We may use an "X" to show one correspondence and a "Y" to show another.

The question about the significance of speaker impedances has been discussed before but, with this small impedance change, you could swap the values back-

(Continued on Page 127)

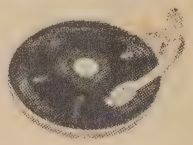
SAVE £2

By trading in your old spring or electric gramo motor

ON A NEW

COLLARO

PLAYER UNIT



During June we will allow you £2 for any old gramo motor or player as part payment on the latest model COLLARO 4-SPEED PLAYER, which plays all type records and incorporates the famous Ronette OV crystal pick-up cartridge. You can save £2 off the list price of

£12/15/6

★★★★★★★★★★★★★★★

BARGAINS —

FUSE HOLDERS

Panel mounting type. Black bakelite for standard 1¼in fuses. Front loading. Usual price 6/9.

Now **3/-**

POTENTIOMETERS

Philips' imported 0.5 meg miniatures will end your volume control worries.

6/3

PERFORATED ALUMINIUM

Very fine perforations. Ideal for ventilation, etc. Size 9¼in x 5in.

4 FOR 2/-

TV POWER TRANSFORMER

290V at 275 mA. Suit R. and H. and A.W.A. type circuits. Fully guaranteed

£6/10/-

TV TURRET TUNER

Nationally known 10-band Cascode tuner. Can be used in all designs.

£15/-/-

HIGH FIDELITY

A complete outfit, ready to use.
MULLARD "3-3" Amplifier.
COLLARO Player Unit.
MAGNAVOX 8WR Speaker.
Enjoy Hi Fi for the small outlay of

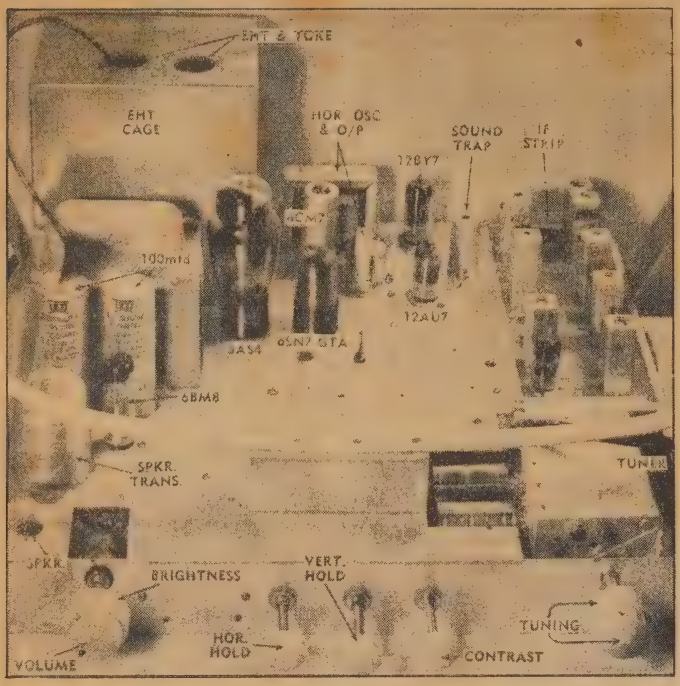
£41/10/-

Please add postage to all orders.

PRICE'S RADIO

5-6 ANGEL PLACE, SYDNEY.

PHONE BL3146



This top view of the chassis, seen through the picture tube supporting clamp, clearly shows the position of the major components. Note the position of the tuner and the cutout which clears the two valves.

Our TV Set For 1958—Part Two

With the help of this second article, you should be able to complete your 1958 Television Receiver. In particular, the article details the wiring of the video amplifier, synch. separator and oscillator stages, the EHT cage and physical mounting of the picture tube.

If you followed the suggested constructional procedure to the point reached in our last issue, you should already have tuned in the three active channels and listened to the sound side of their programs. You will be in the happy position of knowing that this much, at least, of your receiver is in operation.

On the other hand, if you have struck trouble and fail to hear the sound, deal with the problem now. The addition of picture circuits won't correct an existing fault and will represent just that much more circuitry to worry about and to complicate the job of trouble-shooting. However, let's hope that this word of advice is not necessary.

Just before proceeding, a couple of matters relevant to the main circuit warrant special mention.

As explained last month, the circuit is equally suitable for use with 17 or 21-inch tubes, provided they are of the 90-degree deflection type and use electrostatic focus. Four currently available types were listed as possibilities and you can take your pick, having regard to size, brand, price and availability.

Since our last issue went to press, two new types have been announced for local manufacture and distribution. These are the 17BJP4 and the 21CBP4.

Special feature of these tubes is that they have a straight electron gun, as distinct from the conventional bent gun, and, therefore, do not require an ion trap magnet to align the electron beam.

The change allows the use of a somewhat shorter neck than in earlier types, eliminating or reducing the bulge at the rear of the conventional TV cabinet. Manufacturers claim that the use of an aluminised screen, together with other unspecified refinements, has virtually eliminated the risk of ion burn.

Though we have not had opportunity to try either of the new types, the manufacturers state that they will operate in the same circuit and with the same base connections as the other types listed.

Another point concerns the A.G.C. circuit, which was discussed last month. The idea appears to have found a good deal of acceptance and there is a chance that at least some of the I.F. strips will be sold with the additional components already fitted.

The exact value of the A.G.C. diode load and feed resistor is not critical in the circuit as shown. We used 0.33M resistors but higher values, such as 0.47M or 0.68M would work equally well, if already fitted.

VIDEO AMPLIFIER

Continuing now with the construction of the receiver, the next obvious step is to wire the video amplifier stage, which is just alongside the rear end of the I.F. strip. The socket should be mounted with the blank space toward the I.F. strip or the rear corner of the chassis, depending on whether it happens to be a moulded or a wafer type.

Note that the 12BY7 has a centre-tapped heater. Pins 4 and 5 join together and go to one side of the circuit, while pin 6 goes to the other side. We have heard of one or two cases where a mistake here causes the 12BY7 to operate at half heater power, resulting in slow heating, with possible reaction also on the picture quality and synch.

pulse amplitude.

The 12BY7 cathode connects to one side of a sound trap coil, tuned to 5.5Mc and intended to minimise interference in the picture from the 5.5Mc intercarrier beat frequency.

SOUND TRAP

The trap coil can be hand-wound quite readily, using a miniature coil can and former with variable iron slug. The winding consists of 64 turns of 22 B and S gauge enamel close wound about ¼-inch from the bottom of the former.

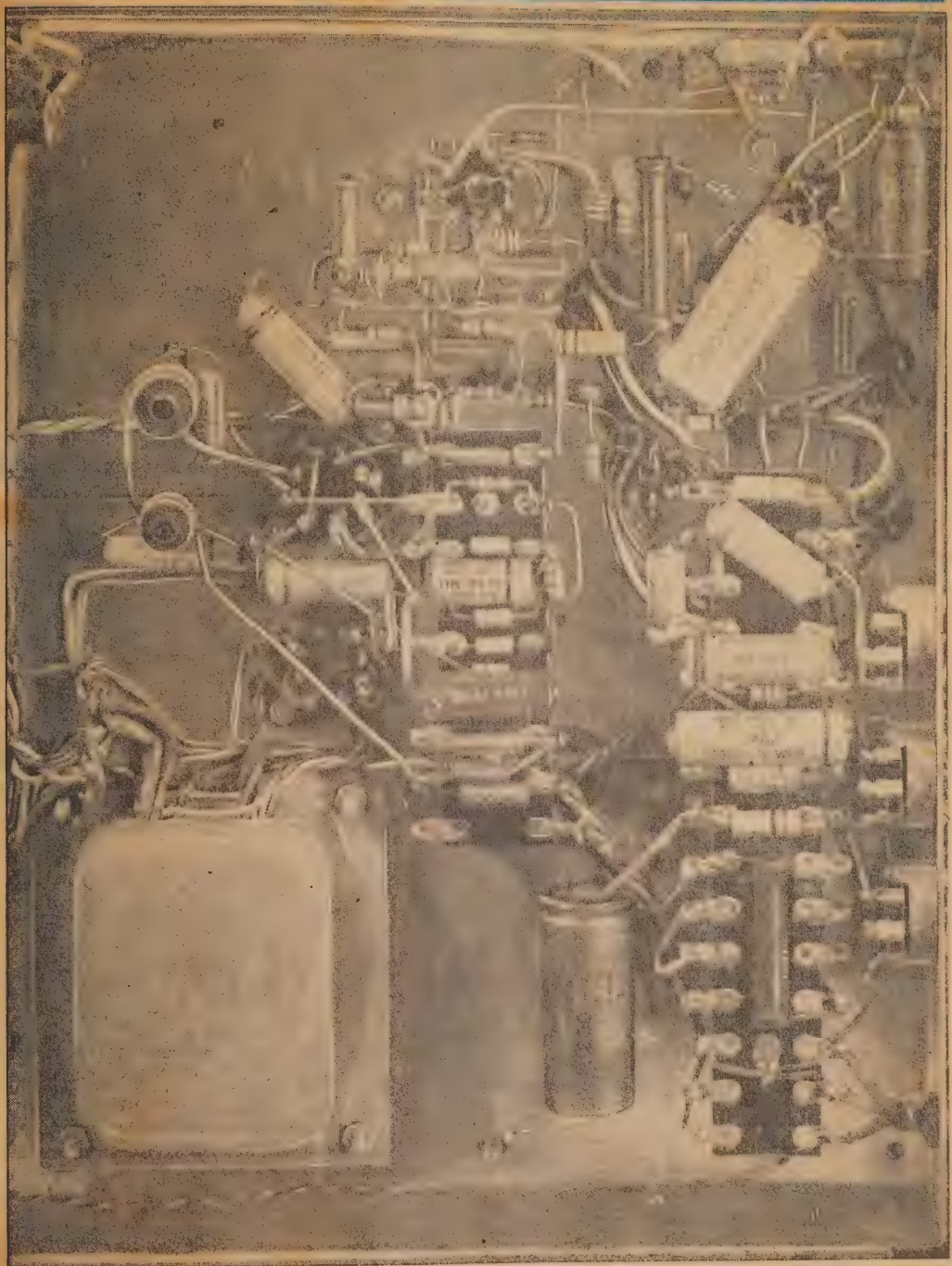
The capacitor can be a paper, mica or ceramic type, preferably close tolerance and most definitely NOT one marked "High K." It can be mounted inside the can, just clear of the winding, if it is small enough.

Commercial trap coils using many more turns of wire and a smaller tuning capacitor are not recommended for this particular position.

This simple cathode trap, as suggested

by Neville Williams

DETAILED VIEW OF THE PICTURE CIRCUIT WIRING



This section of the chassis, shown here in greater detail, contains most of the picture circuit wiring. The video amplifier is at top right, with the synch. separator alongside. In the centre is the line oscillator and its associated panel, while most of the frame circuitry is centred on the panel at the lower right.

VALUE! and superiority!

CHANNEL MASTER

the world's largest range of TV Aerials and accessories!

BEST IN PREASSEMBLED AERIALS

***CHANNEL MASTER*— supplies everything but the roof**

Australia's Nationally Advertised Aerials

CITY VEE
Model 315R.7.

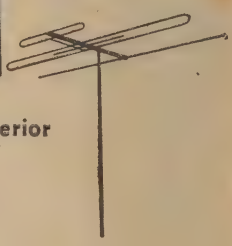
This low priced aerial is proving tremendously popular. It gives excellent results in metropolitan areas covering Channel 1 through 10. People like it because it looks attractive and modern. £6/13/-.

MODEL 310
DUAL FLECTOR

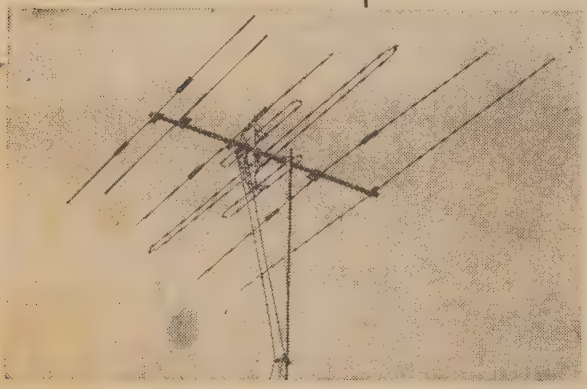
Ideal for strong to medium signal areas. Makes an excellent loft aerial. Covers Channels 1 through 10.

"MAVERICK" SERIES
MOST POPULAR
AERIALS IN AUSTRALIA

RETAIL £7/17/6



- **Low price** ● **Mechanically superior**
- **Fully pre-Assembled**
- **5 models—for every location.**

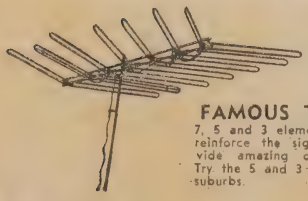


THE RAINBOW MODEL 330

The genuine all-channel yagi, that is so popular in Australia and the American Continent. Full band width and highest gain. Like a forest over roofs in N.S.W. and Victorian Country.

MODELS 1022-1007-Z
MATCH YAGIS

Big, sensitive and best performers of all the long yagis. Easy to assemble — gains tremendously in stacking. Channel Master's BIG 10 has the most gain of all TV Aerials.



FAMOUS TW

7, 5 and 3 elements TW's reinforce the signal, provide amazing directivity. Try the 5 and 3 for outer suburbs.

Available from selected wholesalers!

FREE! 16 page booklet "Better Pictures on your TV Set!" Post Free.

Simply send this coupon to Channel Master

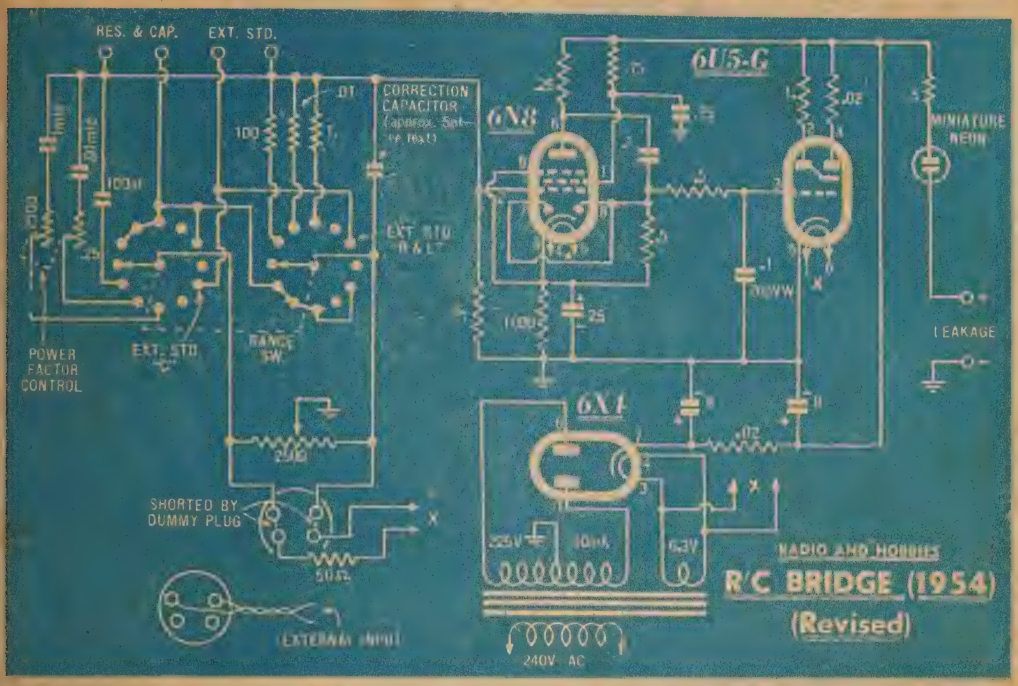
NAME _____

ADDRESS _____

RH658

FACTORY: CHANNEL MASTER PTY. LTD., 752 PITTWATER ROAD, BROOKVALE, N.S.W. XF0221

CIRCUIT DIAGRAM FOR THE AMENDED R/C BRIDGE



The alterations made to last month's circuit are clearly shown in this amended diagram.

stop. It also allows the connections to the switch to be selected on a more convenient basis.

Given that the switching poles on each bank are away from the chassis, you will see the lay of the switch from the photograph. The bank nearer the front panel carries the connections to the standard capacitors.

The 4-tag mounting strip near the ratio control is retained and the connections to it in sequence from the front panel are, the junction of the .01 mfd standard and its .25 megohm power factor control, the earth connection for the moving arm of the ratio control, a blank, and the junction of the .01 mfd and 1 mfd standards.

A 2-tag mounting strip is secured under the nut of one of the mounting bolts of the 6N8 socket to carry the junction of all three resistance standards, the 100 pf capacitor standard, the correction capacitor and the connection to one of the terminals. From this tag strip, a 1in lead runs direct to the 6N8 grid pin.

SMALL CORRECTION

With this bridge wiring, we found it necessary to introduce a small amount of correction for the inevitable wiring and switch capacitances and the capacitance of the terminals to chassis. Naturally, the need for this correction is evident on the "100 pf" range only. We will deal with this later, however, after discussion of the method of calibration.

Incidentally, the procedure to be outlined in the following paragraphs will apply equally well to the bridge circuit published in last month's issue as to the circuit discussed in this article.

What you use for calibration may well depend upon what you have on hand. For instance, for the calibration of the prototype unit, we used the variable arms of an accurate PMG type bridge.

RESISTOR ACCURACY

Then again, some readers may be able to obtain the temporary use of a laboratory type resistance decade box. On the other hand, a reasonable job could be made by selecting appropriate resistance values with a reliable multimeter.

The process of simply picking out by color code certain values of resistance on hand is not one upon which a great deal of reliance can be placed, because an ungraded stock resistor would normally have a tolerance of 20 pc only and, in some cases, may well be beyond this. If some readers are quite happy to approach the calibration procedure on this basis, it is obvious that future readings would have to be treated with caution.

Naturally, the accuracy of bridge measurement of a component value is directly related to the accuracy of the standards and of the resistance values used for calibration, together with the accuracy with which a scale reading can be taken.

Fortunately, the bridge is sufficiently sensitive to give good accuracy in scale indication if a rocking motion is given to the ratio control about the point of "balance" in an endeavor to pin-point it exactly. In some cases, it is helpful to take the mean of say three readings.

If you have no accurate means of calibration at hand, certain values of resistance could be purchased in order to a tolerance of 1 pc or 2½ pc.

Suggested values are 1 each of 5 ohms, 10, 20, 30, 50, 100, 200, 300 and 500 ohms. With these it is possible to make up resistance values between 5 ohms and 100 ohms in 5 ohm steps, between 100 and 300 ohms in 10 ohm steps and between 300 ohms and 1000 ohms in 50 ohm steps.

CALIBRATION

To commence the calibration, you will need a certain number of low tolerance resistors of appropriate values to enable a sufficient number of points to be identified on the scale.

Unfortunately, due to the non-linearity of the scale, it is not possible to mark a few widely separated points and interpolate for the intermediate positions, although this will be permissible between certain major scale markings.

PHILIPS...

...Deliver the GOODS!

Four Brilliant Newcomers to the Popular PHILIPS MICROPHONE RANGE!

On the water! . . . for release EARLY in JANUARY, four brilliant imported newcomers to further expand the already selective Philips microphone range! And without doubt . . . they're well worth waiting for! Philips once again are delivering the GOODS!

the GOODS in QUALITY...

The superior craftsmanship evident in both design and precision finish of every individual component in these new Philips microphones is obvious at first glance! Every effort has been made to combine robust construction with lightness and still maintain eye-pleasing design.

the GOODS in VALUE...

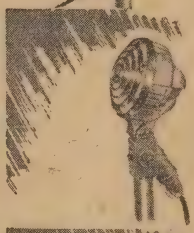
In spite of the fact that these microphones rank in quality with those being offered at double and even treble their price, the overwhelming demand created throughout the entire world has enabled Philips to produce them in such quantities that the highest standards of quality are offered at such a low price!

the GOODS in PERFORMANCE...

In these four new microphones Philips have provided a complete coverage of every microphone application ranging from simple Public Address work to the most exacting requirements of Studio and professional use.

Prices and illustrated leaflets on application to . . .

Type No. EL6040. The most outstanding microphone in the entire range! The "pencil" microphone has a frequency response which is substantially flat from 50 to 15,000 CPS. The exceptional combination of optimum reproductive quality and great mechanical strength opens up quite new possibilities in the public address field . . . broadcasting . . . television . . . and film recordings.



Type EL6030. A hyper-cardioid moving coil microphone. This unidirectional, very sensitive, high quality microphone enables the gain of the amplifier to be increased considerably without risk of acoustic feed-back! Reproduction of ambient noise is so weak that for the same effect the normal speaking distance can be doubled. Tropic rain and dust-proofed.

Type EL6020. Non-directional electro dynamic microphone admirably suitable for high quality sound recording as well as broadcasting use. Due to special design, it is exceptionally efficient where group recordings are being made.

Type No. 9549. A moderately priced extremely robust microphone for general purpose work where reproduction of both speech and music are required. Can be employed just as efficiently in the open air as in enclosed spaces. Equipped with durable plastic diaphragm . . . tropic-proofed. Output impedances: at 10,000 ohms, 2.4 mV. 500 ohms, 6 mV. 200 ohms, .4 mV.

PHILIPS

ELECTRICAL INDUSTRIES Pty. Ltd.

MELBOURNE	590 Bourke St.	FJ6542
SYDNEY	367 Kent St.	BX6486
BRISBANE	148 Edward St.	B2666
ADELAIDE	119 Grenfell St.	W2241
PERTH	381 Murray St.	BA3131

Leave the pigtail connections of these resistors at full length, so that minimum heat is absorbed by the body of a resistor during the frequent soldering in the series connections to give the desired values.

With the switch set to the "100 ohm" range, use the resistance values between 5 ohms and 100 ohms to mark the scale from .05 to 1 in steps of .05. Portion of this range can be interpolated to read in steps of .01 up to say .3.

SCALE MARKS

Actually, the spacing of the ".05" and ".06" marks could be used to carry the scale down to .02. These can be checked as will be shown later. Due to physical characteristics of the ratio potentiometer, the lower scale limit will be .02. The .01 mark is so close to .02 that it must be omitted.

Using the resistance values between 100 ohms and 1000 ohms with the range switch still in the "100 ohm" position, the scale can be calibrated from 1 to 10 in steps of .1 up to the "3" mark and in steps of .5 thereafter.

To handle the range betgeen 10 and 100 on the scale, it would be quite acceptable to use one of the 10 ohm calibrating resistors as a temporary standard on the assumption that it would have been selected to a 1 pc or 2½ pc tolerance. A further point is that the scale is fairly crowded over this small portion and accuracy is limited accordingly.

To use the 10-ohm resistor as an external standard, simply insert it in the "Ext Std" terminals and swing the range switch to the "Ext Std" position. With the revised method of switching, there will be one position each for external resistance and capacitance standards.

With the range switch so set, use the resistance values between 100 ohms and 1000 ohms to mark the scale from 10 to 50 in steps of 10, and jumping straight from there to the "100" mark. There is sufficient room and need to insert the "15" mark.

CHECKING

It was mentioned earlier that the estimated positions for the scale markings between .02 and .1 could be checked. This is done by connecting the 200 ohm, 300 and 500 ohm calibrating resistors in series to make up 1000 ohms, placing the combination across the "Ext Std" terminals and setting the range switch to the "Ext Std R" position.

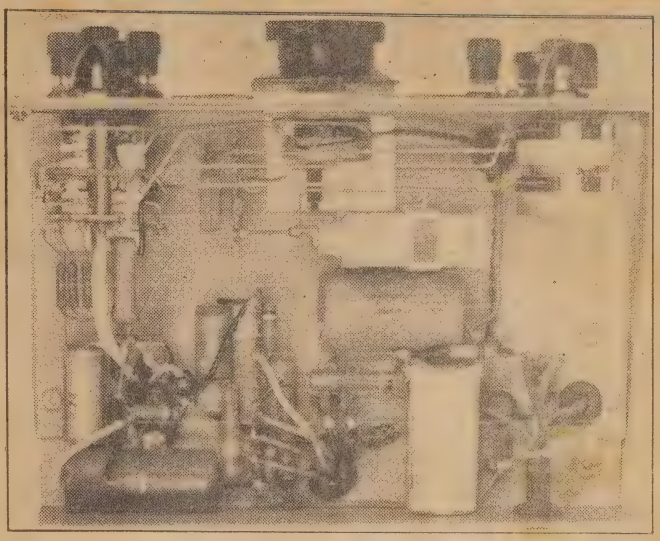
By using the resistors between 20 ohms and 100 ohms and changing the total value in steps of 10, you can check the scale between the .02 and .1 markings.

The whole process tends to sound somewhat laborious but with a little preliminary thought on suitable resistor combination, the procedure becomes quite straightforward.

A temporary off-set pointer could be fitted to the ratio control knob and using a drawing pencil sharpened to a chisel point, the pointer positions can be transferred onto the scale card. The extremities of the pointer travel over the scale should also be marked onto the card to give a setting reference for the knob.

Normally, the scale card is removed after initial calibration so that the calibration marks can be inked in neatly and identified.

UNDER CHASSIS OF THE BRIDGE



The new switch and associated components are grouped at the left.

DOUBLE SCALE

As pointed out previously, the single scale serves for both resistance and capacitance measurement if the revised bridge switching is used. With single bank switching of the standards, as in last month's issue, the capacitance scale is inserted by drawing in the reciprocals of the resistance scale.

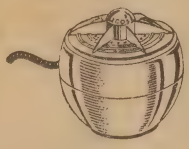
Commence with the centre position 1, followed by the easily observed reciprocals such as 2 for a resistance scale reading of .5, 4 for .25, 5 for .2,

"ACOS" CRYSTAL MICROPHONES AND MICROPHONE INSERTS

The Finest Range Available in Australia for:—

TAPE RECORDERS
PUBLIC ADDRESS
HEARING AIDS
BROADCASTING STATIONS
AMATEUR RADIO

MODEL 35
(HAND/DESK)
PRICE £2/15/-



MODEL 33
(DESK)
PRICE £6/18/6

Front view Only

MODEL 28
(LAPEL)
PRICE £5/19/6

MODEL 22
(HAND/DESK)
PRICE £9/18/6

MODEL 16
(HAND/FLOOR)
PRICE £26/19/6

TECHNICAL DATA SHEETS GLADLY FORWARDED ON REQUEST

"ACOS" CRYSTAL MICROPHONE INSERTS

MIC. 3 SERIES

TYPE	DESCRIPTION	DIMENSIONS	RESPONSE	CODE	PRICE
			at 2500 C.P.S.	Mona	£1 19 3
			" " "	Mervyn	1 19 3
			" " "	Myrtle	1 19 3

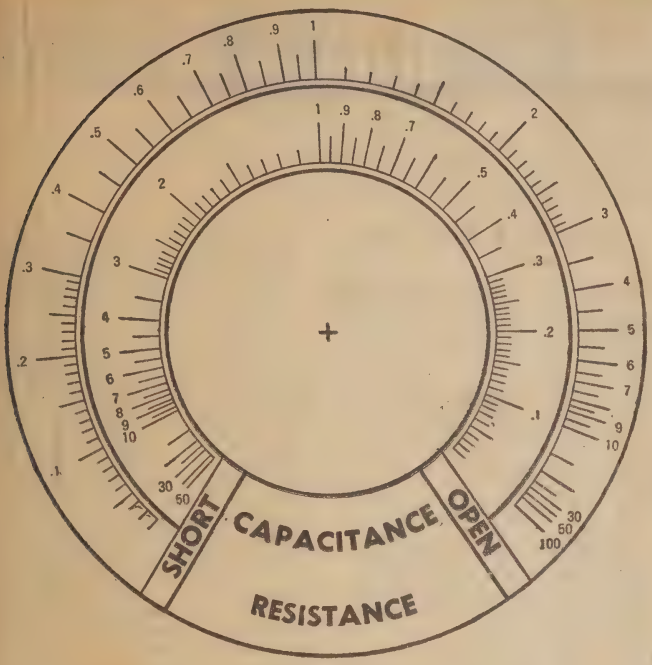
PONSE	CODE	PRICE
at 2250 C.P.S.	Margie	£1 19 3
" " "	Maudie	1 19 3
" " "	Mandy	1 19 3

PONSE	CODE	PRICE
t 3500 C.P.S.	Maxie	£1.19 6
" " "	Mitchell	1 19 6
" " "	Malcolm	1 19 6
" 3000 "	Marlene	1 19 6
" 3500 "	Maggie	1 19 6
" " "	Maisie	1 19 6
to 6000 CPS	Merry	1 19 6

ONSE	CODE	PRICE
3000 C.P.S.	Maureen	£1 19 3
" "	Margaret	1 19 3
" "	Milton	1 19 3
	Martin	2 15 6

nbuilt 10 meg. Resistor.
uses everywhere.

LTD. CABLES and TELEGRAMS AMPLION — SYDNEY



This diagram shows the double scale developed from that shown on page 79.

10 for .1, 20 for .05, and 100 for .01. In the same manner complete markings around the other half of the scale.

The intermediate markings will have to be calculated by dividing the desired figure into 1 and finding this point on the resistance scale to transfer the mark on to the capacitance scale.

When the scale is completed and fitted to the panel again, the knob should be secured to the ratio control shaft so that the pointer coincides with the setting references previously marked.

We went through this procedure with the prototype instrument and to assist our readers, we are printing a full-scale copy of our completed scale card for both the single scale and double-scale versions. It is drawn for an IRC brand wire-wound potentiometer. Other types may have a slightly different law.

This copy could be photographed or actually cut out of the magazine and pasted on to the panel under the protective cover of a sheet of celluloid or thin perspex. We plan to make copies available also through the query service.

Getting back to the small capacitor which balances out the circuit capacitance in the bridge wiring, the appropriate amount of correction was arrived at by setting the range switch to the "100 pf" position, temporarily removing the 100 pf standard capacitor and adjusting the correction until the tuning indicator "eye" showed a tendency to "balance" as the ratio control passed through centre scale.

The indication is fairly broad and not very pronounced because of the very high impedances involved.

Another method of adjustment is to set the range switch to the "100 pf" position with the 100 pf standard in circuit and, with another 100 pf capacitor of tolerance equal to that of the standard connected to the "Res and Cap" terminals, set the correction so that "balance" is obtained exactly at unity ratio.

Although the correction capacitor is in circuit in all positions of the range switch, it has, as would be expected, no observable effect on the other ranges.

CORRECTION

In the prototype unit, the correction capacitor is made up with two pieces of 10/.010 PVC-insulated hook-up wire held firmly together for a distance of about 1¾in with a piece of plastic sheathing. The wires protrude from the opposite ends of the sheathing for about a ¼in to provide a connection for soldering into circuit. The opposite end of each wire is cut off flush with the sheathing.

This simple capacitor fits easily into position between the switching pole of the rear switch bank and the wiring junction on the adjacent 2-tag mounting strip.

(Continued on Page 104)

AWA
RONETTE
MICROPHONES & ACCESSORIES

Type HM7
£6/7/11
Hand or stand microphone, filter-cell, robust die cast housing attractively finished.
NEWTON McLAREN
17 LEIGH ST., ADELAIDE.
and leading wholesalers

IMMEDIATE DELIVERY
OF THE
WORLD'S FINEST
TAPE DECKS
BRADMATIC
MODELS 5B-5C-5D
FITTED WITH 6RP HEADS
3 MOTORS. 2 SPEEDS. 3 HEADS.
Fully automatic Push Button Control. Genuine Bradmatic Component Parts always available.
Full details gladly sent by return mail
MELBOURNE AGENT:—
MARCO RECORDING STUDIO
192 TOROONGA RD., GLEN IRIS.
or from Sole Distributors for SA and WA. ELECTRONICS AUST. PTY. LTD., 70 Eton St., N. Perth, WA.

OFF THE RECORD — NEWS & REVIEWS

Really funny records are few and far between in this blase age, and it requires a touch of genius to produce one which can hit a high award. But Philips have given us just that in their release of Anna Russell Sings Again.

By JOHN MOYLE

ANNA RUSSELL SINGS AGAIN — recorded in the New York Town Hall. Philips B07028L.

On one side of the disc, this amazing woman tells us the story of Wagner's "Ring", with vocal and pianistic illustrations, which will lay you out in the aisles.

It is a tribute to Wagner's genius that we can laugh at the absurdities of his situations, the melodramatic progress of his action, and the interminable complication of his plots, and do so with a clear conscience.

Anna Russell makes the most of all these without at any time reaching an anticlimax. The most avid Wagnerian will laugh with her in the sure conviction that her barbs are well aimed, but I am sure they will afterward reach for their favorite "Ring" records just to see whether they are as silly as all that.

The insidious part of her delicious foolery is that, despite our appreciation of it, our reacquaintance with the magnificent music is neither lessened nor harmed.

For some of the themes she sings so well that we will wonder whether she is laughing up her probably non-existent sleeve in a kind of musical double-take.

On the second side she does the same thing with her version of how to write your own Gilbert and Sullivan opera. Both these things are filled with so much slapstick and so much real wit that they defy description in a few words. You must hear them to appreciate to the full how good she is.

The third item is a speech by a Woman's Club president, in which we hear her as herself, and in which she preserves her world class as a comedienne.

The recording is of the highest high-fidelity class, which is the last requirement to earn the five stars. I give them with my compliments.

GILBERT AND SULLIVAN AND DANNY KAYE—selections from various G. and S. opera with Victor Young and Johnny Green's Orchestras. Festival-Decca CFR10-513.

By contrast, Danny Kaye.

He sings well-known excerpts from G. and S. opera with the same technique as he uses for the "Little Fiddie" and "Knock on Wood". Whether this record is a try-out to see whether he can safely embark on a series of filmed G. and S., I don't know, but I sincerely hope better judgment will prevail.

Without making any particular case for the work of this famous pair, I must recognise that the selection given here, including many of the famed patter-songs, are only successful when sung in character appropriate to the times, and that considerable finesse is needed in creating and maintaining such character.

For instance, the judge in "Trial By Jury" is at the opposite end of the emotional and social scale to the policeman in the "Pirates", and more than the adoption of an unearthly accent is needed to show the difference. In any case, hasn't Danny heard of the constitutional dignity of the London bobby, even on stage?

NEW TRINITY?

To sell the idea that this record creates a new trinity, Gilbert, Sullivan and Kaye, is the height of something for which I cannot find a word. The addition of topical and modernised verses to "bring G. and S. up to date", shows the wisdom of controlling possible violence to their work for so long. The only thing Danny Kaye brings to his task is an ability to enunciate his words at high speed, but even this art as exercised by him shows a total lack of G. and S. understanding.

I agree with the jacket note that Danny Kaye fans might be interested in G. and S. by this disc, particularly as a reaction against Johnny Ray and Frankie Laine. But it will take a minor revolution to make the reverse come true.

BEETHOVEN—Symphony No. 3, E Flat Major (Eroica) Opus 55. Played by the Berlin Philharmonic Orchestra, conducted by Paul van Kempen. Philips A00177L.

An exceptionally fine record in every way. Musically, it is truly a heroic "Eroica", and will, I am sure, delight all those who look for the full drama and magnificence of this great work.

The conductor sees it in a big way, the orchestra responds to his mood, and the recording has the size, reverberation and dynamic range to support them both.

Its massive proportions are carried over into the third movement which is often played at a faster tempo, and I would have liked a quicker pace. But I must admit it is in character, and is so well done, and its outlines so clear, that even if you agree with my view you will still accept this for what it is.

CLEAR OUTLINE

This matter of clear outline is demonstrated all through the performance. Even when the weight is applied it does not become muddy. The bite of the strings is still there, nor do they swamp the other instruments, which you will hear all in their places. The reverberation holds the sound together at all times. There is no impression that the rest have gone home when only a few instruments are scored.

And behind it all is a beautifully-recorded bass. The deepest double basses have their full sound and at the same time are never tubby or out of control. The closing bars of the second movement give us an admirable example. In this respect, the disc is an object lesson.

The frequency range isn't the fullest, but it's wide enough to give completely convincing sound. The surface noise is almost non-existent, and it plays cleanly. I found NAB the best setting.

I think this record is good enough to nudge the five stars. I am certain that a better one will have to be right out of the box.

BRAHMS—Symphony No. 1, in C Minor, Opus 68. Played by the Residency Orchestra — The Hague, conducted by William van Otterloo. Philips A00198.

It is interesting to compare this disc with the Eroica released with it. It is good average quality, but the Beethoven shows from a recording point of view what could have been done had both been made at the same time and under the same conditions.

I like this symphony played with rather a broader sweep, a more heroic line, a more dramatic touch. Here it is almost a leisured stroll for the most part, not missing very much, it

"For those who can hear the difference"

Your ear detects the subtle shading of a piano, clean brilliance of violins, the purity of a flute.

. . . yes, even the iridescence of clashing cymbals, the roundness of a clarinet, the mellowness of cellos. You can hear the difference for these are the thrilling new listening experiences released for your enjoyment by "Connoisseur".

The Connoisseur (reg.) in 3 speeds, 33 1-3, 45, and 78, full 12in turntable, is available with new lightweight pick-up (interchangeable heads).

★ Due to import restrictions deliveries are slow. But please be patient!

J. H. MAGRATH & CO. PTY. LTD.

208 Lt. Lonsdale St., Melb. FB3731.

is true, but with little sense of urgency.

The last movement builds up quite well, but there isn't a great deal of excitement, even in the acceleration of the plucked strings near the beginning, which can be so effective.

But all this is just my view—there is a good deal of fine playing in the disc, and as quiescent Brahms, it is very good, indeed.

The recording is bright enough — not wide-range, but big in atmosphere and weighty when called upon. There are no difficult spots.

The surface is particularly clean, and its noise level very low. I'd say it is a very safe buy, but I don't think we've heard the full field as yet. Nevertheless, this disc is likely to run into a place in any company. An NAB curve I found best.

BEETHOVEN—Concerto No. 4 in G Major, Opus 58. Played by Solomon and the Philharmonia Orchestra, conducted by Andre Cluytens. HMV, OBLP 1036.

A most distinguished performance in typical Solomon style. His approach to the music is quiet, relaxed, musical and restrained.

He gives us the key in those opening bars, some of the most eloquent in all Beethoven's major works. I could not help contrasting their ring with the way Gieseking gives them out, to say nothing of Schnabel.

And yet for all his quieter mood, Solomon builds an authority for his outlook, which is the hallmark of a ranking pianist. He makes no apologies and he needs none.

Under his hands the music may not reach its fullest stature, but it does achieve great beauty and dignity. If you know Solomon you will know what I am trying to convey. His tone as usual is impeccable throughout.

The good recording standard and quiet surface make this a fine record. It plays best with EMI or NAB curves.

STRAVINSKY.—The Rite of Spring. Played by the New York Philharmonic Orchestra, conducted by Igor Stravinsky. Columbia 330CX1083.

On the whole I would agree with others who have said that Stravinsky doesn't make as much of his music as do some other conductors. If there is starkness and sharp outline required of the music, then he achieves it, if at times the edges are to be softened and the tale told with more subtlety and flexibility then he does not. I have played several versions of this work and doubt whether anyone can say much more than that.

If you would like to have a picture of the music as Stravinsky sees it, then you won't go wrong with this record. Technically, it is much on a par with others, and at times its impact is more powerful than anyone else has achieved.

CHOPIN.—Impromptu No. 2, Ballade No. 2. LISZT—La Campanella. STRAUSS—Carnival of Venice. Played by Poldi Mildner, Pianist. Radiola-Telefunken LB6060.

A record which makes us wonder why piano recording should have been a technical bogey for so long. This is really good reproduction, and although on the Liszt-Strauss side we have some of the most truly percussive music written for the piano, it comes through as clear as a bell, with no suspicion of overload or unease.

In fact I liked this side the best, for I though it exhibited the pianist's fine technique better than his less sensitive Chopin. The microphone seems to hug the keyboard, but despite this deadly electronic spotlight, his clean fingering and even control come through with vivid honors.

A most attractive piano record which should sound fine on all instruments.

HUMMEL—Septet Opus 74 for piano, flute, oboe, horn, viola, double bass and cello. Westminster WL5018.

This is a somewhat disappointing record.

What promised to be an interesting combination of instruments failed to impress me with any real reason for bringing them together. I could find nothing homogenous either in themselves or in the way they were used.

The piano is the most important member, and could well have been left to wade through the music on its own. Once or twice there do emerge some intriguing little bits, but generally speaking the effect as recorded is patchy.

Incidently did Beethoven build the Kreutzer from this first movement or vice versa?

Neither the recording nor the pressing I thought up to Westminster's usually high standard. The piano tone breaks up almost from the first, and instrumental balance isn't the best, although this may be the composer's fault.

It is an interesting recording, the more so because of Hummel's acceptance as a contemporary of Beethoven. But then Beethoven's occasional use of strange combinations are scarcely stiff competition, are they?

Verdict—try it out for yourself.

MOZART—Marriage of Figaro, concert version of musical numbers sung with the Netherlands Philharmonic Orchestra conducted by Walter Goehr. Nixa MLP-2010.

If you are a Mozart connoisseur you will probably not enjoy this record as much as you would if your favorite individual singers were all gathered together. Because so much of this music is well-known, and has been recorded by big names, that comparison with singers such as Tauber for instance is inevitable.

But for the average music lover who is thankful to the art of the LP record for an opportunity to hear the complete Figaro music with only one turnover, and for those who haven't yet sampled the beauties of this opera, Nixa's release will be most welcome.

The jacket also contains the Italian words of the main arias by the use of minute type which at least is better than none at all.

It is recorded somewhat remotely which I thought quite a good thing, as it helps to blend the singers and orchestra with a sense of theatre which is totally absent when the microphone is crowded and reverberation almost absent.

The singers are remarkably even in quality. Some of their work is extremely good, but it would take too long to comment in detail. I for one would be very happy to welcome them any time they cared to come to Sydney.

The recording is rather light, but this isn't significant because the surface noise is quite low, and if not perfect cannot be heard above the music, except in a couple of spots which may be peculiar to my particular disc.

BRAHMS—Symphony No. 3 in F major played by the Vienna Philharmonic Orchestra conducted by Karl Bohm. Decca LXTA2843.

This I think must be one of the best recordings of this symphony so far, if it is not the outright winner. At least I cannot remember one which I would place ahead of it.

This does not mean that I think it is an ideal performance, nor is my idea of it necessarily the best.

The things I am not so keen about are firstly its over-meticulous handling. To me the impression is of careful guidance through a work which I'm sure the Vienna players could rattle off with one hand—figuratively speaking of course.

And with this careful approach goes a tempo slow enough to show the toolmarks of the musical workshop a little too clearly.

I think both the second and third movements could have stood more animation, although the first and fourth measure up better to the in-

ROYCE PHONE FB2592.

RECORDING EQUIPMENT

FOR HOME AND STUDIO
YOU CANNOT DO BETTER THAN
INSTALL THIS STANDARD OVER-
HEAD TRAVERSING
GEAR PRECISION
BUILT FOR
STANDARD OR
MICRO LINING

Price £15/-/-

HI FI
CUTTING HEADS,
STELLITE AND
SAPPHIRE STYLI

Labels, Stroboscopes, Turntables, Blanks and All Accessories for the Recordist. Write for Catalogue of Prices.

PLAYBACK RECORDING SUPPLIES — BOX 5041Y, G.P.O., MELB.,
SALES AND SERVICE, 291 EXHIBITION ST., MELB.
S... Aust. Rep., Scott Sales, Richards Bldgs., 99 Currie St., Adelaide.

New

ACOUSTICAL

QUAD

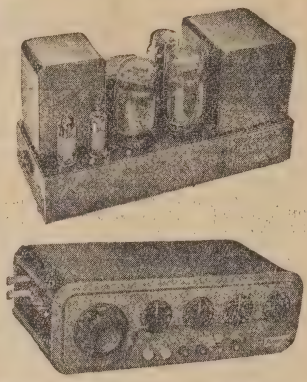
The most distinguished audio achievement of recent years.

Combining Highest Engineering Standards with New Concept of Styling for the Home.

Unique stability, with less than 0.1% total distortion. Higher order distortion, 0.03%.

Amplifier and Control Unit

WE URGE YOU, in your own interest, to check the Acoustical QUAD technically, count by count, with the finest contemporary achievements . . . to audition the Acoustical QUAD for yourself, to prove it the world's finest amplifier.
When you have inspected and auditioned the Acoustical QUAD Amplifier and Control Unit, we think you will agree that it is the world's finest — for performance, for appearance.
The QUAD is truly an instrument designed for the home. Its beautiful styling is unparalleled in the hi-fi industry. Its specifications are second to none. And those specifications were deliberately obtained with up to 20% tube mismatch, to be certain that the QUAD in your home will always exceed its published specifications.



- *Gracefully styled to match the decor of your home.*
- *Effortless Finger-tip control.*
- *Full range fidelity 10 to 60,000 cps plus or minus ½ db.*
- *Push-button recording equalisation and program channel selection.*
- *Perfect plug-in matching to pick-up selected.*
- *Complete Input flexibility, by interchangeable plugs.*
- *Built-in pre-amp; 1.5 mV sensitivity upwards.*
- *Automatic circuit correction.*
- *Independent filter and filter slope controls.*
- *Bass and treble designed for musical balance, independent of harmonic filtering.*

See and hear it at:

UNITED RADIO DISTRIBUTORS PTY. LTD.
Radio-Electrical Wholesalers.

Showrooms: 175 Phillip St., Sydney. BL3954.
Sole Australian Agents: British Merchandising Pty. Ltd.

LOW VOLTAGE PHOTOFLASH CAPACITORS

T.C.C. LECTROFLASH lightweight electrolytic capacitors are designed for use with the new photoflash tubes operating at reduced voltages.

With the range of capacitor ratings now available, series or parallel combinations may be used to provide the desired light output with any flash tube operating up to 1000 volts.

LECTROFLASH capacitors may be used with dry batteries or rectified AC power supplies. In the latter case, the power supply should be designed so that the rated peak working voltage of the capacitor is not exceeded under any operating conditions, including mains variations. (The "peak working voltage" is the sum of the DC component plus the peak of any ripple voltage.)

Leakage current is less than 1 mA. Capacitance tolerance is minus 20% plus 50%.

TYPE No.	CAPACITANCE (Mfds.)	PEAK WORKING VOLTS	LENGTH (Inches)	DIAMETER (Inches)	WEIGHT (Ounces)	RETAIL PRICE (Including 16-2/3% Sales Tax
SCE36PE	120	500	4½	1½	6	28/3
SCE60PE	200	500	4½	1¾	9	32/10
SCE60HE	650	250	4½	1¾	9	40/7
SCE60FE	900	180	4½	1¾	9	44/4

SCE60HE is the correct unit for use in the circuit in "Radio and Hobbies" for April, 1954.

Available from leading suppliers. *Trade inquiries to:—*

UCC

UNITED CAPACITOR CO. PTY. LIMITED

433 Punchbowl Road, ENFIELD, N.S.W. UW3511

MELBOURNE: 486 Bourke Street.
ADELAIDE: Stephen & Co., 83 Grenfell Street.
BRISBANE: Tecnico Ltd., 103 Albert Street.
PERTH: O. F. Gamble, 384 Murray Street.

UCC. HP.3

trinsic tempo of the music, and flow much more freely.

And lastly the bass response is on the light side. I found it played best with NAB and even more bass if possible.

Otherwise I thought it a grand bit of work. It's not really wide range, but the orchestra plays beautifully and sounds well. The Vienna soloists have always been good, and on this record they handle their little bits as well as usual.

The surface noise cannot be heard over the music and it plays cleanly through to the end. A very good, safe disc to buy.

BEETHOVEN—Symphony No. 7 in A major Opus 92. Played by the Symphony Orchestra of the Belgian National Radio Institute, Brussels, conducted by Franz Andre. Radiola-Telefunken LSK 7023.

This is a good stock record, but I could not select it for any features which are really outstanding.

The general musical approach is painstaking, consistent and authentic, but I did not think it had anything beyond that to make it a performance which impressed itself on my mind.

Actually it could have sounded better had the recording been a little less "middly". It would do better on the average radiogram than on wide range gear, where I found an NAB setting with extra bass was best.

But even then the overall effect was rather rowdy, particularly in the last two movements which are taken at something of a rattling pace.

It is quite easy to play. There is nothing to present difficulties for any pick-up, nor any lack of clarity throughout.

There is not a great deal here yet to compare with this disc, although I note there are a number of "Sevenths" about to arrive. It should be interesting to play them together, for this one had been well commented upon overseas. I would look for a bit more class when selecting "the" version, if we can have such a thing.

MOZART — Concerto in G major for Flute and Orchestra KV313. Played by the South German Chamber Orchestra, Stuttgart, conducted by Rolf Reinhardt, with Willy Glass as soloist. Radiola - Telefunken LB6047.

Everything seems to have gone right with this record. Not only is the music Mozart in his most delightful mood, but it is played by an orchestra and soloist who are completely at their ease and of one mind about how it should go.

It is true chamber music in its conception and in the way we hear it here. Such happy intimacy would be lost with a big band of players and that is a quality this music demands for its right setting.

The recording, too, is smoothly handled, with a good instrumental blend, and enough reverberation to allow the flute's tone to hang in the air, as it does with particularly fine quality in the first movement cadenza.

The soloist is of high class, and the fine tone referred to is not the only of his accomplishments as a player.

Technically the disc is not extremely wide in range, but is nicely balanced and with very low surface noise, inaudible on almost any equipment.

It is a four star record which will please everybody.

MOZART—Trio No. 3 in E major, No. 5 in G major. Played by Agi Jambor, piano; Victor Aitay, violin; Janas Starker, cello. Nixa SPLP 521.

This is one of three records issued a couple of years ago by Nixa of six Mozart piano trios which, as the jacket notes point out, are rarely played. They have varied histories, and the two recorded on this disc include what is probably the best of the six in K542, and the last to be composed, K564.

The latter was originally written as a piano sonata, but eventually saw the light in this form. The piano is undoubtedly more prominent for this reason, and the musical ideas of lesser interest despite its later day of composition. Its form, too, is not as complete nor as finished as K542.

The general standard of performance and recording is high. The pianist is perhaps the weakest link, and the cellist the most impressive players. He shows out as a fine musician, with firm, strong tone which gives a glowing color. The ensemble is excellent.

A somewhat dead recording studio provides a clearly etched sound which is by no means out of place and adds to the vividness of instrumental tone. This is very good—only in the last few bars of K564 is there even a minor criticism of overweight on the part of the piano.

The surface is much the best of the three discs, with a low percentage of crackles which in no way interfere with the music.

One I can recommend.

JOHANN STRAUSS — Waltzes; Vienna Blood, Wine, Women and Song, Tales from the Vienna Woods, and the Emperor. Played by the Minneapolis Symphony Orchestra conducted by Antal Dorati. Mercury MG50019.

The Mercury Olympian series makes a technical feature of the single microphone technique, a Telefunken suspended 15ft above the conductor. We've learned this one off by heart now, but of course it doesn't tell all the story. To allow the single point to be successful, orchestral placement and chamber acoustics have been most competently handled as well.

There doesn't seem to have been much effort to chase the highs, the concentration being on the all important matter of balance. This without doubt is very good. Quite often the effect of presence is accompanied by extreme contrast between the orchestral sections concerned. Here they are grouped so that they fall quite naturally into place.

The reverberation is also under good control. It is there to provide atmosphere, and never clouds the issue.

The result is most attractive, clean-cut sound.

I hesitate to say that the orchestra plays in the true Viennese manner, but it does have the kind of swing that represents it for people who haven't been able to make their own comparisons. I doubt whether in Vienna they would like the music to sound quite so upright, although they would probably enjoy it played out in full even if we think it a little long.

If you like Strauss you get plenty of the best here, and it is well worth the money.

BEETHOVEN—Sonata No. 9 in A major Opus 47 (Kreutzer). Played by Zino Francescatti (violin) and Robert Casadesus (piano). Philips A 01609.

This is a very good recording of one of Beethoven's most famous violin sonatas, in many ways one of the hardest to play. Both soloists are big names in the musical world and we would expect nothing less from them.

Not everyone will like Francescatti's recorded tone, however, which tends to become a trifle shrill and scratchy under pressure, nor does the pizzicato always sound convincing, although in justice to him I think there are sections of this work where it is difficult if not impossible to avoid such an effect.

But he makes light of the technical difficulties, and both men have a completely adequate view of the sonata as a whole.

I have no quarrel with the record technically. It is a clean player, the balance is OK and the violin although forward doesn't sound too close for comfort.

It is one of the best Kreutzer's of the moment.

CHOPIN—Ballade No. 1 in G minor Opus 23, Mazurka No. 17 in B flat minor Opus 24 No. 4, Mazurka No. 20 in D flat major Opus 30 No. 3, Mazurka No. 24 in C major Opus 33 No. 3. Played by Wilhelm Backhaus Decca LWA 5026.

I have always liked Backhaus playing Chopin, although in some ways I'd find it hard to say why. It may be a hangover from those fine concerts he gave some years ago in Australia in his prime, when a pianist of his stature was an event.

It may be that he is such a sane, safe pianist—his musical integrity and judgment are never in doubt, and he has a masculine outlook which helps to supply a firmness to Chopin which is often lacking in more sensitive performances.

From a recording point of view the Ballade is least successful—it suffers from some tone break-up which spoiled many of his earlier records, but the other side is quite OK. Apparently the items were recorded at different times, for the microphone placing isn't the same. The surface is very quiet.

If you think as I do you'll listen with pleasure to these records made by one of the most versatile pianists of the last fifty years.

LE ROY ANDERSON— Irish Suite played by the "Pops" Concert Orchestra conducted by Le Roy Anderson. Festival-Decca CRR10-431.

And very nice too! This is one of Festival's best light records and should go over in a big way. Leroy Anderson is an arranger of considerable note in USA and with these Irish tunes he displays the right type of imagination and very considerable skill. I don't think I have ever heard a more competent effort of its kind.

The playing, too, is first rate. There are six numbers in all, and although they are all good I would pick the "Last Rose of Summer" the "Minstrel Boy", and the "Wearing of the Green" as particularly good.

The recording is bright, vivid, and with tons of bite. The edge is a bit pronounced on the strings, unfortunately also on the solo violin in the "Last Rose", but an NAB setting tames it pretty well even with wide range.

Four stars, and well worth it.

A TAPE RECORDER FROM MAGNETIC SOUND INDUSTRIES IS A YEAR ROUND ASSET. BUY ON EASY TERMS

We sell only Tape Recorders—and to stay in business must give you a fair deal. Our prices are most competitive and repairs and service the best. We sell only leading makes in new tape recorders and pass our specialised experience on to you. Used tape recorders are priced very keenly, viz.:

1 AWA £79/10/-, 1 Elcon £75, 1 Pyrox £89/10/-. 1 Sound Mirror, fair order £55. 1 Elcon, as new, £95.

NEW GRUNDIG TK9

for

£25

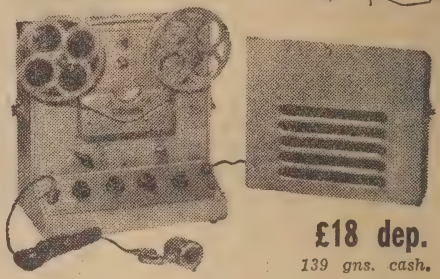
Dep.

Cash price £152/10/-

The world's finest tape recorder. 1½ hours' recording. Automatic track change, auto stop, unique time clock, fully press button. Widest frequency range—and the best buy for the music lover.

New and used models from

£10 Dep.



£18 dep.

139 gns. cash.

NEW MOVIE TAPE TECNICORDER

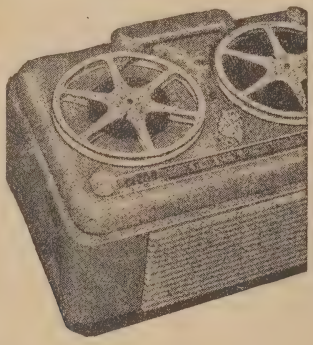
Unique Tape Recorder has separate syncro device to attach to 9.5 mm, 8 mm, 16 mm projectors, giving you "Sound on Film". Two hours' recording, two speeds, two tracks.

Elcon

£18

DEP.

Cash price £128/15/-



Ideal for musical groups. Superb reproduction and made to last. 1 hour's recording, 2 speed, P.A. system. 6 months' guarantee and free service.

See, too, the **7-valve Elcon Radio-Corder £154/10/- or just £25 deposit.**

STOP PRESS!

EXCLUSIVE RELEASE of the famous Philip's Tape Recorder. Different in design, different in reproduction. Cheaper to run and we give 12 months' guarantee. £136/10/- or £18 dep.

TAPE, TAPE, TAPE Stocks of Tape here! All makes, E.M.I., Scotch, B.A.S.F., Grundig, etc., from only 39/6.

REPAIRS All makes, all types. Moderate charges. We pick up and deliver.

HIRE A TAPE RECORDER Try one out before you buy. Hire one for your next party, musical evening or dance.

MAGNETIC SOUND INDUSTRIES (Aust.)

Only One Address 385 GEORGE ST. RIGHT OPP. STRAND ARCADE

TAKE LIFT TO LOWER GROUND FLOOR.

OPEN SATURDAY MORNINGS 9-12 BX4440 BX4440

BINAURAL RECORDS TAKE A BOW

Looking back over the past year, I have found it most gratifying to note that a very large number of the new records listed have found their way to Australia only a short time after their English or American release.

The binaural set-up with the two Ibbott pick-ups.

I REFER to the records issued under the COOK label in America, sometimes referred to as "Sounds of our Times". For some years Emory Cook has been well-known in American record circles as a searcher after technical perfection on disc, and from time to time he has released recordings which stand alone, both for the quality of the sound, and the sheer ingenuity of the program material he uses. Some of you may have heard "Rail Dynamics", or his remarkable actuality recording of a thunderstorm.

More recently, he has ventured into what should probably be called "legitimate" recording, with Hi-Fi items on the harp, zither, guitar, theatre organ, piano, and full orchestra.

FIRST BINAURALS

In April 1953, the Cook Laboratories pressed for the first time commercially what they termed "Binaural" versions of certain of their recordings, and since then their catalogue of these discs has grown bit by bit, until a few months ago they issued in one release Stravinsky's Concerto Grosso, Brahms No. 1, Bach's Suite for Strings and Brandenburg Concerto No. 3, Romeo and Juliet, the Serenade for Strings, Barber's Adagio for Strings, Honegger's Pacific 231, and others, all of which were recorded in Boston's Symphony Hall, acoustically a fine location for recording purposes.

These records are intended for playback on the Cook System, which means that two pick-up heads are required to traverse the disc simultaneously, spaced just under 1¼in apart. The output from each pick-up is taken to its own equalising pre-amplifier, amplifier, and speaker system, and the two speaker cabinets should be placed about 10ft apart along a wall, and not, as is usual with ordinary disc reproduction, facing out from corners of the room.

The two microphone channels are recorded on separate tracks on the discs, and the two playback channels must not be interconnected at any stage.

On tape, the mechanical arrangement for two tracks is not difficult, and already some of the new RCA tapes are available in binaural versions for home use. As a matter of record, it is interesting to recall that the German Radio Network were producing stereophonic tapes commercially in 1942, and British and American researchers sent to investigate after the war reported that "the quality was so much superior to that obtained by all other available recording methods that the RRG (German Radio) regarded it as their duty to make recordings by this method, particularly of the masterpieces of classical music, to be kept for the benefit of future generations".

MECHANICS

On disc, the mechanics are not so simple, but an experimental binaural pick-up has been made in Melbourne recently, which tracks successfully over the disc. Two high quality amplifiers have been used in this set-up for reproduction through two identical speaker systems, each consisting of two Woofers and Two Tweeters.

The "program" is at present limited to two discs only, which have been specially imported, and I say without reservation that when these discs are playing the effect obtained provides artistic reproduction of such high quality that it can be regarded as a substitute for direct listening by even the most exacting audience. The extraordinary difference between single and multi channel must

(Continued on page 89)

Deutsche Grammophon Gesellschaft

"CLASSICAL RECORDS SUPREME"

featuring

Wilhelm Furtwaengler
Ferenc Fricsay
Igor Markevitch
Eugen Jochum
H. v Karajan
Victor de Sabata
Fritz Lehmann
Irmgard Seefried
Erna Berger
Elfriede Troetschel
Heinrich Schlusnus
Walther Ludwig
Petre Muneanu
Peter Anders
Joseph Greindl
Wolfgang Schneiderhan
Wilhelm Kempf
Adrian Aeschbacher
Andor Foldes

polydor

CONTINENTAL

Light and Jazz Records

"WITH A DIFFERENCE"

featuring

Helmut Zacharias
Barnabas von Geczy
Werner Mueller, RIAS DANCE ORCH.
Kurt Edelhagen "PROGESSIVE" Orch.
"Schraage Otto" — Tipsy Piano
Alfred Hause Tango Orchestra
"MIDNIGHT in MUNICH" Jam Session
Rudi Schuricke
Willy Schneider
Lale Andersen
PIONEERS of 7" (45r.p.m.) Recordings.

Available from selected dealers.

IMPORTED AND DISTRIBUTED BY:

FRED A. FALK & CO. PTY. LTD.

28 King Street, Rockdale, N.S.W.

Phone LX 4783

You'll need a PLATTERBACK

4 BIG NAMES NOW AT MAGRATHS

TRANSCRIPTION!

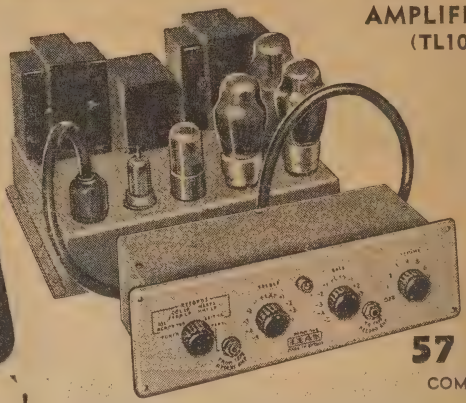
TURNTABLE, 3-speed MOTOR and TRANSCRIPTION UNIT

Model 2010 (above incl. inset sketch of turntable): the perfect record reproduction for the critic! Complete unit mounted on rectangular plate. Equipped with a STUDIO "P" Hi-fi pick-up head with special low resonance arm and bearing. Balanced (flywheel effect) non-magnetic turntable (approx. 8½lb) with rubber turntable mat. "Wow"-free motor (for AC voltages of from 100/125 and 200/250) at 50 cycles per sec. Entirely new type 3-speed mechanism free from rumble and frequency modulation. Features also Voltage Control Panel. Unit is finished in cream scratch-proof enamel.

Price £22/10/-

LEAK

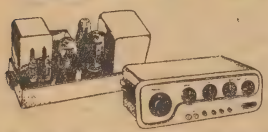
AMPLIFIER and PRE-AMPLIFIER (TL10)



57 GNS. COMPLETE

Specially designed to reproduce music identically the way it was played. Illus. above: **TL/10 Power Amplifier and "Point One" Pre-Amplifier.** Specifications: **Circuitry**—a triple loop feedback circuit based on the famous TL/12 with same size TL/12 transformer; **Max. Power Output**— 10 watts; **Frequency Response**—plus/minus 1 db 20 c/s to 20,000 c/s; **Harmonic Distortion**—0.1 pc., 1000 c/s 7.5 watts output; **Feedback Magnitude**—26 db. main loop; **Damping Factor**—25; Hum 80 db referred to 10 watts; **Loudspeaker Impedances**—16 ohms, 8 ohms and 4 ohms; **PICK-UP:** Pre-Amplifier will operate from any branded pick-up. Continuously variable input attenuator at rear of pre-amplifier permits instantaneous use of crystal, moving-iron, and moving-coil pick-ups. **RADIO:** input sockets permit connection to any tuner unit. **DISTORTION:** of the order of 0.1 pc. **HUM:** negligible. **INPUT Selector:** radio, tape, records accurately equalised. **TREBLE:** continuously variable, + 9 db to − 15 db at 10,000 c/s. **BASS:** continuously variable, + 12 db to − 13 db at 40 c/s. **VOLUME Control and Switch** controlling power supply to TL/10 power amplifier. Features TAPE Recording Jacks.

QUAD II



AMPLIFIER and CONTROL UNIT

The most distinguished audio achievement in recent years! Unique stability, with less than 0.1 pc total distortion. Higher order distortion, 0.3 pc. Full range fidelity 10 to 60,000 cps + or − ½db. Push-button recording equalisation and program channel selection. Complete Input flexibility. Built-in pre-amp; 15 mV sensitivity upwards. Automatic circuit correction. Bass and treble independent of harmonic filtering.

AEGIS

AMPLIFIER UNIT

Provides a 3rd dimension in sound! Valve complement: 6X4 rectifier, 6AQ5. Power output: (4.5 watt), 6AV6 input stage. Frequency response: 40 — 15000 cps + or — 2db (controls in flat position). Input impedance: 0.5 megohm (suitable for crystal pick-up only). Output impedance: 2.3 ohms. Damping factor: less than 1 ohm. Separate bass and treble control. Special attention has been given to treble cut. Price: £30.

MAGRATHS HI-FIDELITY SOUND CENTRE

Distributors of "STENTORIAN" SPEAKERS and famous "CONNOISSEUR" PRODUCTS.

380 ST. KILDA RD., MELB. (opp. the Shrine). 'Phone: MX3653

(OPEN SATURDAY MORNINGS)

RECORD NEWS FROM ABROAD

While the prominence given to classical issues on microgroove has tended to push the more "popular" style of music into the background, there is no lack of enthusiasm in this direction among record companies.

By DISCOBOLUS

During the past year we have seen albums featuring all the well-known variety artists, as instanced by the Glenn Miller and Louis Armstrong recordings. American Decca celebrated their 20th anniversary in the record business with a sure-fire seller devoted to the man who made most of their money for them in the early stages—Bing Crosby. The album contains five LP's, and a total of 89 songs by Bing, playing for a shade over four hours.

While I cannot imagine anyone wanting to play this set right through very often, I would face the prospect rather more cheerfully, I think, than I would a mammoth release on the Clef label in America recently. The idea is that some people like Art Tatum, and if they like Art Tatum they like him a lot. So, why not some LP's? In fact, lots of LP's—14 of them.

CLEF LP's

And this is exactly what Clef have done. This is, I think, the most exhaustive session so far in the jazz field, and all the material is newly-recorded, taking only three sittings. Five of these LP's were released together a few months back, and the remaining nine are to come out early in the new year.

RCA are taking their jazz very seriously, and have formed a new subsidiary which will issue "X" records. All these are taken from items in the Victor catalogue in the 20's and 30's, and 100 10in LP's are planned. The first 10 discs are already out, and regular issues will be made over the next three years until all is complete. At the same time, another company has secured rights to reissue jazz classics on record labels which became defunct many years ago—such companies as Paramount, Circle, Black Swan and Gennett—and operating under the "Riverside" trademark they have a program of just on 250 LP's, of which they have already released 33. It is pointless to try and name the artists on these new records, as everyone who has ever been known to jazz followers is on these discs.

COLUMBIA RELEASE

There will be no pretence to high fidelity on these records, of course, but Westminster and Vox are building up quite a collection of newly-recorded jazz designed to attract those who like their Fi Hi and their music Lo.

Taking a middle course, Columbia are pressing on with their Opera Without Words series from Kostelanetz and his Coloratura Orchestra. Added to orchestral versions of Carmen and La Boheme now are Tchaikovsky's Queen Of Spades and Verdi's Traviata. Although I have not heard any of these, I am certain that Kostelanetz will have a large following among those who like their opera, but only up to a point.

Over to the Haydn Society for a moment, to find that they plan to make available all of Bach's organ music, played by Finn Videroe, the whole of Mozart's piano music, whether in solo or ensemble, by Lili Kraus, and the whole of the Anthologie Sonore. This society has now completed the set of Beethoven Quartets, into the bargain.

The gallery of Pictures At An Exhibition must now surely be complete, with a new version—this time by Toscanini (it had to come sooner or later)—for RCA. This company has now joined those who make demonstration records, with the difference that their latest features the NBC Symphony Orchestra — not, however, with their maestro. Technically good records from this orchestra are sufficiently rare to make this disc worthwhile, if only to know just what they really can sound like.

Among other New Ortho releases from RCA is Berlioz' Damnation Of Faust, with the Boston Symphony and Charles Munch. Also Les Patineurs and Gaite Parisienne, plus a number of works by Richard Strauss with the Chicago Orchestra under Reiner.

RCA IN ENGLAND

RCA's latest to reach England is Toscanini, once again, on the HMV label with the Enigma Variations and Brahms Variations On a Theme by Haydn.

Westminster have evidently found that there is some demand, after all, for their highly-priced Laboratory Series. Their latest addition to it is Gliere's Red Poppy Ballet. This was originally coupled with his Symphony No. 3 on an "ordinary" LP, and it would be most interesting to compare the two cuttings and pressings on wide-range equipment. Recent Westminster recordings in America include Shostakovitch's Symphony No. 1 and the Golden Age Ballet, eight Sonatas for Flute and Harpsichord by Bach, two Bartok Piano Concertos played by Edith Farnadi, Berlioz' Harold In Italy, Schumann's Piano Concerto, two of Tchaikovsky's, Cesar Frank's Symphony, Bach's Art of the Fugue, and two Chopin Concertos.

BINAURAL RECORDS

(Continued from Page 87)

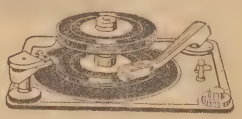
be heard to be properly appreciated, but the spatial effect is truly startling and most satisfying to experience. Cook have not resorted to the ruse of grouping various instruments around the two microphones—which would cause an observer to imagine that the listener was watching a tennis match — on the contrary, the impression I gathered was one similar to a front-row-centre seat in the balcony of the concert hall.

Full credit for the demonstrations which have taken place goes to Mr. J. K. Ibbott, who has constructed all the equipment involved. I feel that I have had a glimpse into the future during these past few weeks, and I like it; which is a good note on which to commence the New Year.—Discobolus.

Dual

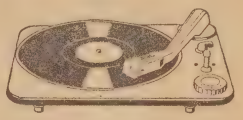
For all THREE speeds

DUAL Recordchangers and players are the most advanced models available in Australia today. Masterpieces of engineering, their flawless reproduction ranges from 20 cps. — 15,000 cps. Recordchanger 1002F will change 10 MIXED 10in and 12in records and 10 7in records **with large centre-holes.** Changers and players may also be used manually and 7in centre inserts are **supplied** free with each unit.



DUAL Changer Model 1002/F complete with NORMAL and LARGE CENTRESPINDLES.

PRICE (Sydney) **£35/12/6**



DUAL 3/Speed player chassis 275 complete with 3 position scratch filter, already mounted on springs.

PRICE (Sydney) **£19/10/6**

Available from better dealers everywhere.

DUAL Recordplayers and Changers are marketed and serviced by

FRED A. FALK & CO.

PTY. LTD.

28 King Street, Rockdale, N.S.W.

Telegrams: GRAMOFALK.

PHONE: LX 4783.

Agents in all States

SHORT-WAVE NOTES BY ART CUSHEN

AMERICAN FREEDOM CRUSADE

Radio Free Europe was established in 1949 to broadcast to the Communist-controlled countries of Czechoslovakia, Hungary, Poland, Rumania and Bulgaria. It began broadcasting in July 1950 over one mobile short-wave transmitter, for a few hours a week. Today, with 23 powerful short and medium wave transmitters located in Germany and in Portugal, its broadcasts are on the air more than 3,000 programme hours a week.

RFE is unique among stations speaking to the Iron Curtain peoples in that it is not the voice of a foreign power It operates a network of "home stations from abroad" (The Voice of Free Czechoslovakia, of Free Hungary, Free Poland, Free Rumania and Free Bulgaria). Those who write and broadcast from the respective stations are the most talented editors, actors, writers, journalists and musicians of their nationality living in the free world; among them are to be found experts in all fields. However, the organisation is supported financially by millions of American citizens who have joined this crusade for freedom. Unlike other foreign stations, which broadcast, at the most, only an hour or two a day to captive countries, Radio Free Europe programs are on the air 20 hours a day.

THE TRANSMITTERS

The transmitters of RFE are located in West Germany and in Portugal and several transmitters in the latter country have a signal of 100,000 watts. At central headquarters in Munich, approximately 1000 Germans, Czechs, Slovaks, Hungarians, Poles and Rumanians work side by side with Americans in close co-operation.

Radio Free Europe's frequency list is as follows:—

Kcs	Kcs	Kcs
719	7180	11745
854	7192	11755
3960	7235	11760
5960	7285	11815
5970	7295	11830
5985	7300	11855
6015	9505	11885
6020	9595	11915
6095	9607	11940
6130	9655	15115
6150	9695	15145
7105	9712	15170
7140	9715	15185
7145	9717.5	15195
7155	9725	15215
7165	9750	15265
7175	11725	15365
	11735	15420
		17895

The schedule are as follow:—

Czech-slovak services: Weekdays, 1.58 pm to 9.0 am, 10.5 am to 10.35 am, in the 75, 49, 41, 31, 25 and 19 meter band. Sundays, 3.38 pm to 9.0 am (Mondays), 10.5 am to 10.35 am (Mondays), 75, 49, 31, 25 and 19m.

Polish Service: 1.55 pm to 6.25 pm, 7.53 pm to 12.20 am, 12.53 am to 9.0 am, 9.35 am to 10.5 am, in the 49, 41, 31, 25 and 19 meter bands.

Bulgarian Service: 2.55 am to 3.45 am, 4.25 am to 5.15 am, 5.55 am to 6.45 am in the 49, 41 and 31 meter bands.

Hungarian Service: 1.56 pm to 9.35 am on 49, 41, 31, 25 and 19m. Sundays 3.57 pm to 9.35 am (Mon.) on 49, 41, 31, 25 and 19m.

Rumanian Service: 3.45 am to 4.25 am, 5.15 am to 5.55 am, 6.45 am to 7.26 am, on 49, 41 and 31m.

News is broadcast every hour on the hour in Czech, Hungarian and Polish.

CBNX NEWFOUNDLAND

STATION CBNX (whose original call letters were VONH) was installed in 1939 by the Broadcasting Corporation of Newfoundland as a supplement to their standard broadcasting transmitter. When Newfoundland joined Canada in 1949 the Broadcasting Corp. of Newfoundland was absorbed by the Canadian Broadcasting Corporation, and the call letters changed from VONH to CBNX.

The transmitter site is at the location of a World War navy wireless station in the suburban district of Mount Pearl, seven miles west of St. Johns. It is interesting to note that it was on "Signal Hill" (at the entrance to St. Johns Harbor) that, in 1901, Marconi received the first transatlantic signal from Poldhu Cornwall, England. The present transmitter site stands at the same elevation as "Signal Hill" (500ft), but about eight miles west of this historic site.

MODERN STUDIOS

Studios are of modern design and are located in Duckworth St., St. John's. CBNX is linked with the CBC network which extends from St. Johns, Newfoundland, to Vancouver, BC. This network consists chiefly of landline on the mainland of Canada with an FM link across the 90-mile stretch of sea which separates Newfoundland from Nova Scotia.

All transmissions are on 5790Kc, the transmitter being a Canadian Marconi type GP-300-8; power input 300 watts. Tubes in final amplifier, 2-type 813. The antenna is a half-wave, Delta Matching, 78ft 5in long, height 75ft, and signals are directed approximately east and west.

The daily CBC time signal commences at approximately 3.59½ pm, and ends with a long dash, the beginning of this long dash indicating exactly 1 pm, EST (Canada). The transmission is followed by appropriate explanatory announcements

N.B. C.B.C., Canadian Broadcasting Corp

All reports for Voice of America stations throughout the world should now be sent to the Voice of America, 330 Independence Avenue, Washington, 25, USA.

Listening Post

Good signals from 7.30 pm on-

4100 Far East Network, Okinawa. ward.

Usual AFRS programmes

4970 YVLK "Radio Rumbus" Venezuela, closes 4.45 pm on Sundays.

6060 HCIAC "La Voz de la Democracia", Quito, Equador. Strong to 3.50 pm. Closes on Sundays.

6248 Budapest, Hungary, good at 2.0 am.

6752 Larissa, Greece, fair signals from 3.30 pm.

7010 APK2, Karachi, Pakistan, strong signal at 5.0 am.

15150 CR[illegible] "Radio Coroporacion", San[illegible] Chile, heard from as early as 9.30 am.

FLASHES FROM EVERYWHERE

THE LIBERIAN BROADCASTING COMPANY'S station at Monrovia is reported by Radio Australia on 6022Kcs at 8.15 am with identification at 8.45 am given as "You are tuned to ELB1 in Monrovia. GOLD COAST'S SHORT WAVE station". ZOY on 4915Kcs with 5Kw is expected to be replaced by a 20Kw one late in 1954. ZOY at Accra is currently heard on 4915Kcs between 10-11 pm.

THE IVORY COAST'S Radio Abidjan is reported by Radio Australia as operating on 4945 Kcs with 5Kws from 4.45 pm to midnight and 3.30 to 7.30 am. On Sundays it has been heard opening at 5.15 pm.

According to Radio Australia the Japanese commercial stations JOZ 3925 and JOZ2 6055Kcs, have changed their English programs to 5.50 to 6 pm.

The Blue Danube Network has ceased operations in the 31 metre band and is now transmitting on 5020 and 3270Kcs.

Radio Omdurman at Khartoum is reported by Sidney Pearce on 4995Kcs with Arabic at 3.30 am and identification given at 3.45 am.

Radio Sabah at Jesselton, North Borneo, will increase power next year when a new 5 to 7.5 kilowatt transmitter is brought into use. Tests are expected to take place in June or July. Radio Sabah has assigned frequencies on 5980, 6090, 7180, 7240, 9660 and 9740Kcs. The current schedule is on 7237 Kcs, with 250 watts, English 1.50 to 3 pm on Mondays, Wednesdays and Fridays. Native programs are heard on Sundays, Tuesdays from 2 to 2.45 pm and Fridays 3 to 3.15 pm.

RADIO FRANCEASIE is reported by Ron McEwan of Melbourne as on 9775 Kcs at midnight. Signals vary owing to interference from nearby stations.

LEBANON BROADCASTING STATION at Beirut on 8036Kcs is now on the air on weekdays at 2.30 to 5.30 pm, 8.0 to 11.15 pm, 1.0 am to 7.30 am. Fridays at 2.30 pm to 11.15 pm, 1.0 am to 7.30 am (Sat.), Sundays at 3.0 pm to 11.0 pm and 12.30 am to 7.30 am (Mon.). Programs in English at 1.0 am and in French at 5.0 am.

FORCES BROADCASTING STATION, Benghazi, Libya, has been testing at 2.0-4.30 pm, and 8.30-2.15 am on 7220Kcs, and at 2.30-7.0 am on 3305Kcs.

FM IN BRITAIN

WITH the annual report of the Australian Broadcasting Control Board urging amendment of the Broadcasting Act to let commercial broadcasting use FM, it is interesting to note that the British Government has at last sanctioned the construction of nine frequency modulation transmitters.

In Australia the shortage of medium frequency wavelengths has brought the board to the conclusion that the solution is to use VHF FM to supplement the existing medium wave AM services and in support of the recommendation states that there are 560 FM stations in operation and 9-million FM receivers in use in the United States. In Western Germany there are 103 FM stations.

The British plan calls initially for nine stations, with six transmitters at each—two in parallel on each of the three programs. The first station will be at Wrotham in Kent, where there have already been two experimental stations since 1950. It is expected to be in operation next May. The other eight stations will be at the sites of projected or existing TV stations and will use the same masts. These will be completed by the end of 1956.

The frequencies have not yet been announced but it is presumed that they will be within the framework of the "Plan for Band II" drawn up at Stockholm in 1952, viz. between 88Mc and 94.5Mc. Four will use a power of 120Kw and the remainder 60kw.

THE HAM BANDS WITH BILL MOORE

Amateurs since the inception of radio have investigated many interesting features of transmission propagation. Currently American operators are working on a newly recorded variation on the reflection from the ionosphere of VHF signals.

AMATEURS in America in recent months have been conducting some interesting investigations on propagation on the 144 Mc band. "Burst" signals have been recorded over many long distance paths at times over 1000 miles.

These bursts of signals have been observed for a number of years on these frequencies, firstly in 1940 when VHF FM was introduced and later on TV transmissions.

This s the first occasion that serious investigation has been carried out to ascertain the source of reflection.

The "bursts or pings" may only last a few seconds, and to ensure the maximum effect powers have been increased to the full KW and arrays installed with many more elements than have normally been in use. W2UK is now using 64 elements and W2NLY 48 elements.

Over paths up to 1000 miles five to 30 pings were recorded during a five-minute test period. At other times bursts were long enough to identify call signs running up 30 seconds duration with signal strengths reaching tremendous levels.

Tests were conducted over 24-hour periods and reels of tape used to obtain a full record of signals received.

The general idea is that these signal bursts are reflected by ionised meteor trails in the E region of the ionosphere and it is believed that these bursts will eventually be heard up to 1500 miles and farther.

To obtain some intelligence from the signals as received, new operating techniques are necessary. Callsigns are transmitted at high Morse speeds, later to be identified by slow running of the tapes.

Two stations making tests alternately transmit for minute periods, as many callsigns and signal reports being given as possible during the test period. A new S code for these tests is in use—S1 denoting extremely short bursts, S2 15-second bursts, S3 bursts for periods from 15 seconds to two minutes and up to S5, long periods as yet not recorded.

It is pointed out that the job is one for high power and many elements, not for normal transmitters and arrays.

The work is attracting attention in scientific circles and these reflections are not to be confused with those recorded during thunderstorms. Meteor effects are seldom observed on signals closer than 400 miles.

A paper on the observations has been prepared by Ed Tilton, W1HDQ, QST VHF editor.

It will be presented to the International Scientific Radio Union meeting to be held shortly in Holland.

AMATEUR HAMFEST FOR JANUARY

The annual hamfest of the NSW division of the WIA will be held in Sydney at the Royal Agricultural Society's offices at the Showground on Saturday, January 29. Commencing at 2 pm, the show will run right through the afternoon and evening. A full program, including lectures, competitions, entertainment, will be presented. Light refreshments can be obtained if required.

Amateurs in the country will have an opportunity to participate. A complete amateur station will be operating from the Showground to contact country members. Each contact will be numbered and later in the evening lucky numbers will be drawn covering these QSOs and prizes awarded to country amateurs.

A trade exhibition of gear suitable for amateur equipment will be presented and operators attending will have the opportunity of seeing the latest in imported and local radio parts.

It is anticipated that many country amateurs will visit Sydney for the convention and full details and final arrangements of the convention will be given via the bulletin and over VK2WI official broadcasts.

The sixth annual convention of the North Coast and Tablelands zone, NSW, is again scheduled to be held over Easter at the usual venue at Urunga. Amateurs are reminded of the event, which attracts amateurs from interstate. The usual comprehensive program is being arranged. The dates are Saturday, April, 9 to Monday, April 11. Full details will be published at a later date.

The organisation is in the hands of the following committee. Patron, Crieff Retallick, VK2XO, president, Allan Williams, VK2FH; secretary and zone officer, Noel Hansen, VK2AHH; organiser, Ted Gabriel, VK2AVG; and registration officer, Rod Pike, VK2ACU.

ROSS HULL TROPHY

EARLY in December the first days of the WIA's Ross A Hull memorable trophy contest saw some excellent openings on the 50 Mc band. The best Dx available was VR2CG, Fiji, who contacted all Australian States during the opening days.

Openings occurred from NSW to New Zealand, Western Australia and other Australian States. Scoring well at this early stage were VK4NG and VK3ATN, who seemed to be ahead of other competitors.

Interest in the contest appeared to be higher than last year and a sporadic E opening lasted nearly all day on the first weekend. The contest lasts for two months until the end of February and will assist to sustain interest on 50 Mc during the Dx season. Good scores will be amassed, especially among those lucky enough to be on holidays during the period.

Robbie VK2US, who recently returned from the US, brought back an interesting pamphlet giving some idea of the intense competition, interest and organisation carried on by the leading Dx hands in the States.

It is a folder from Don Wallace, W6AM, and circulated among local Californian amateurs. It lists the various countries that Don requires for his DXCC credit.

W6AM's tally of countries confirmed is currently at 246, but he still requires many new prefixes. He invites telephone calls either to his office or home when any of the listed countries appear and promises to come on the air within a few minutes of receiving such information. He hopes then to make suitable impression with his KW and renowned antenna farm.

Operation Roof Top

OPERATION "Roof Top" is scheduled to be conducted on January 8 and 9, when on those two days a 144 Mc signal will be transmitted from Australia's highest point, Mt. Kosciusko.

Well-known NSW VHF enthusiasts section president Peter Healy, VK2APQ, and committeeman Roy Hart, VK2HO, will journey specially to the spot to produce the necessary signal.

Up some 6000ft, the transmission should provide excellent coverage and create considerable interest among VHF enthusiasts both in NSW and Victoria.

Operating portable using an 832, a coaxial final tank and 20 watts input, the antenna will be three stacks of three elements—suitable equipment to ensure some distant contacts. The receiver will consist of a cascade front end and normal IF channel.

TVI IN ENGLAND

Some time ago it was mentioned that UK amateurs had received a "new deal" from the Post Office in the matter of TVI. It was to the effect that, providing amateurs suppressed all harmonics outside the authorised bands and the TVI was due to choice of IF or image response of the complainant's receiver, he could continue to operate.

That was permitted one month after the complainant had been notified as to the true reason for the interference. The arrangement was restricted to areas where the TV signal is a good one.

This new arrangement has, however, been the subject of headline comment in the daily Press. One Sunday paper carried the words "TV faces big blot out" right across its front page.

The secondary headline was as follows, "No interference ban on amateurs goes". The text stating that tens of thousands of TV viewers would have their reception spoiled or blotted out.

The RSGB since the outburst have been active trying to present the true facts concerning the regulation and explaining it only operated where the TV receiver design was responsible for any interference caused.

CONGRATULATIONS, VK5!

Congratulations to the VK5 division on winning the 1953 Remembrance Day contest, the first victory for a State outside VK6 or VK7 since the current rules were introduced.

The VK5 leading six stations, VK5MS, 5RG, 5EN, 5WC, 5FO and 5WO, did a very creditable job in recording such high tallies.

The results of recent contests are in the hands of the actuaries.

They are analysing these results in an endeavor to establish new rules that will ensure more interest in the contest and to afford all divisions an equal opportunity to win the trophy.

NOTES ON DX

The 14 Mc band in November and early December was still providing DX interest. Rarer stations heard included ET3S, Ethiopia, ES1D, 14060 Kc/s, 2000 hrs, MP4QAH, on Halu Island.

The Africans around 0200 hrs were consistent, the best session of VQs and ZSs heard for a number of years. Other stations creating interest were VQ8CB, 14075 Kc/s, Chagos Archipellago, VS5KU, on Brunei, HE9LAA, Liechtenstein, ST2NG, Box 516, Khartoum, 0630 hrs, TI8TB, OD5LJ and CE7ZU.

Other South American prefixes heard were FY7, CP, ZP and VP8s.

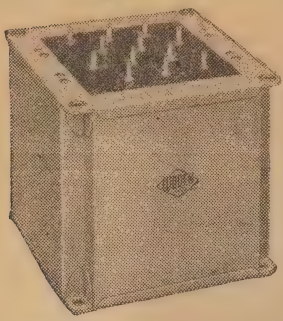
VQ6LQ, British Somaliland, around 2200 hrs, created considerable interest but reported that VK signals only peaked for short periods. He promises to QSL but Gordon VK2DI, who contacted him years ago as ZD1LQ, points out he is still waiting for the ZDI QSL card.

John VK1PG on Heard Island expects to pull the circuit breaker around March 1954. He has been the most active of the island's stations and will be missed when he returns to operate VK2PG.

Bill VK1EG does his best to make as many contacts as possible from Mawson, Antarctica, but explains he is often doing various chores from cooking onwards.

He would like to spend much more time on the air but feels duty bound to perform his share of other less interesting work. At times he has difficulty in keeping schedules with VK4FJ due to stations calling him and would appreciate the co-operation of all stations.

Carefully Designed FOR ACCURATE MATCHING & MAXIMUM EFFICIENCY



WODEN MULTI-MATCH MODULATION TRANSFORMERS MADE IN ENGLAND

Features.

1. Potted type compound filled (vacuum impregnated).
2. Universal application.
3. (a) Primary impedance range — 2000 ohms to 18,000 ohms.
   (b) Secondary impedance range — 200 ohms to 21,000 ohms.
4. Highest efficiency—lowest weight per watt.
5. Easy to solder heavily silver plated tags.
6. Above or below chassis wiring.
7. Capacity—30 to 250 watts as under.

List No.	Audio Watts.	Watts R.F. Input.	Max. Sec. Current.	Overall Size L. W. H.	Weight lbs.	Weight ozs.	Price
U.M.1	30	60	120 m/a.	3⅞x3¼x3⅝in.	5	8	£6/9/11
U.M.2	60	120	200 m/a.	5¼x4¼x5¼in.	11	8	£9/17/2
U.M.3	120	240	250 m/a.	5¼x4¼x5¼in.	14	8	£12/2/5
U.M.4.	250	500	400 m/a.	10¼x6¾x8¾in.	41	0	on appilcation

Including Sales Tax.

For Minimum Hum - Maximum Efficiency!

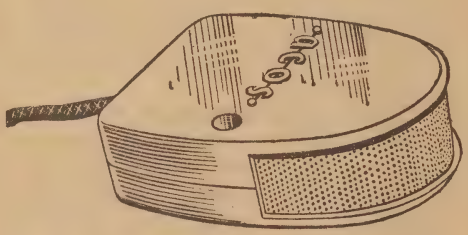
WODEN MICROPHONE TRANSFORMERS

Enclosed in a drawn heat-treated case of heavy gauge nu-metal, this type M.T. microphone transformer is suitable for use where MINIMUM HUM pick-up and MAXIMUM EFFICIENCY is required. It is designed for use with a moving coil microphone from 15-30 ohms impedance and on type MT.101 the centre tap of the primary is connected to one side of the secondary earth. One home fixing allows rotation for minimum hum pick-up. Dimensions: 1in dia. x 1½in long. One hold fixing: 7/16ths in dia. hole.

Type MT.101. Ration 50: 1 overall. Price, £3/14/6, including Sales Tax.

Available from selected wholesale houses in all States!

Australian factory representatives: **R. E. CUNNINGHAM PTY. LTD.** 118 Wattletree Road, Armadale, S.E.3, Vic., and 184 Victoria Road Drummoyne, N.S.W.



A NEW SENSATIONAL CRYSTAL MICROPHONE!

ACOS MIC 35 (HAND AND/OR DESK TYPE)

AT THE AMAZING PRICE OF

£2/15/0

A general purpose microphone with high sensitivity and substantially flat characteristic. Housed in attractive Die Cast Case of very robust construction is particularly suitable for use in recording apparatus — Public Address Equipment — Dance Bands — and similar applications.

Provided with built-in shunt resistance of 2 megohm giving response substantially flat from 50/5,000 cps. Resistance of the input circuit will reduce the low frequency response. A grid leak of ½ megohm will reduce the output at 500 cps by 3 dbs and pro rata at lower frequencies.

Approximate capacitance of the microphone is 750pF and cable capacitance will reduce output proportionately.

Frequency response	Substantially flat from 50/5,000 cps.
Output level	= 55 db ref. 1 volt/dyne/cm2.
Load resistance	2 megohms included.
Cable	This microphone is supplied with approximately 4ft. 1.2 metres of co-axial cable (type Unirad 32).
Weight	Microphone only — 6oz. (approx. 170 grammes) complete with packing 7oz. (approx. 198 grammes).
Dimensions	Microphone only 2 7/8in x 2 1/8in x 7/8in plus cable. Complete with packing 3 3/8in x 2⅜in x 2⅜in.

Australian Agents: AMPLION (A's ia) PTY. LTD., Sydney, N.S.W.

Don't forget the 1954 BERU contest, CW nly, running for 24 hours from 0001 hrs MT Saturday, January 29, to 2359 hrs MT Sunday, January 30. Full details and ules were published in the December sue.

VOY WOY FIELD DAY

The NSW division's Woy Woy field day as held in late November with nearly 00 persons in attendance. As usual, the eather was excellent. Since the in-uguration of field days at this location e elements have always been kind.

It is just 21 years since the first com-ined Newcastle-Sydney was held in the istrict. They were originally held at Vyong under the auspices of Owen Chap-an, VK2OC, and Phil Levenspiel, K2TX.

Since that date they have been held nnually except for the war years. They re now a combined effort of the Hunter ranch and Sydney division.

The following amateurs were among ose in attendance: VK2ASW, 2HZ, 2VC, YA, 2ARF, 2LX, 2KR, 2GE, 2AKR, 2ABV, OT, 2ZP, 2EL, 2AQO, 2XT, 2OQ, 2ASE, AWQ, 2ACD, 2EO, 2YC, 2ZC, 2FP, 2AAB YB, 2AOJ, 2JX, 2AVK, 2AXZ, 2AOR, 2XY, AUH, 2FM, 2AHA, 2DG, 2ANA, 2APX, AMG, 2AEF, 2AEZ, 2AJ, 2AML, 2ZW, ACU, 2ABU, 2ANU, 2VU, 2KG, 2PU, 2YL, PZ, 2AJM, 2VG, 2ID, 2AZN, 2NG, 2YR, YM, 2IT, 2AH, 2CE 2APQ 2HL 2AJZ, GD, 2AAJ, 2AGD, 2SF, 2AET, 2AGO, ZAK, 2AGW, 2ACI, 2GR, 2CS 2VY 2EH, RU.

As usual, a long list of competitions were onducted the following were the winners. n a number of cases XYLs won prizes that eally belonged to the OM.

Judging the voices competition, 20 ama-eurs in action, was won by Ted Whiting, VK2ACD, with Mrs. VK2AGW in second lace. Apparently Bert's shack must be n the house. The recording was pro-uced for the occasion by Hec Harvey, VK2ACI.

The Morse test with interruptions was ecorded by Dave Duff, VK2EO. Two Newcastle amateurs, Jim Cowan, VK2ZC, nd Ken Greenhalgh, VK2KG, filled first nd second places.

Ken was again a winner when he was he only amateur to identify the five-alve types on display. VK2YA, 2LX, 2PZ, AKR, 2SF and 2AHA all listed four-alves correctly.

ALL-BAND SCRAMBLE

The all-band scramble, any band, any ower, run over 45 minutes was well upported, with 11 stations in the field. Harold Whyte, VK2AHA, contacted 24 tations to run out as winner of the cup resented for the event.

The other field event, the 144 Mc hidden TX search conducted by the VHF section, ttracted 17 parties to the hunt. The ecreted transmitter was manned by John Miller, VK2ANF, Bill Barden, VK2ABZ, Bob Winch, VK2OA, and Es Griffiths. Well hidden outside the available map imits, the search was keener than usual nd it was only at the end of 55 minutes hat the transmitter was found.

Two parties, one led by Rix Hay-att, VK2AET, the second by Ken Mit-hellhill, VK2ANU, tied for first place, oth arriving together. Horry Lapthorne, K2HL, was in second place, his time 3 minutes.

A.O.C.P. CLASS

The Victorian Division A.O.C.P. Class will commence on Thursday, 3rd February, 1955.

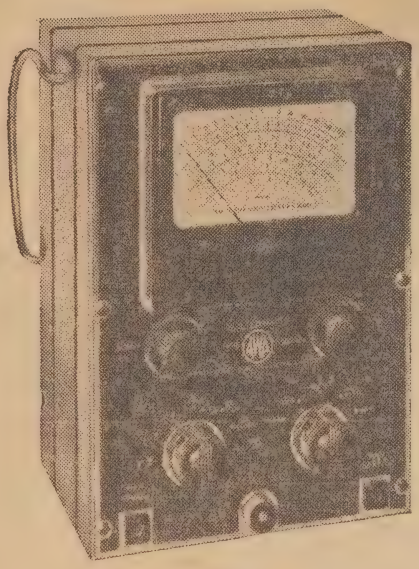
Morse and Regulations are held on Monday and Theory on Thurs-day evenings from 8 to 10 pm. Persons desirous of being en-rolled should communicate with the **Secretary W.I.A., Victorian Division, 191 Queen St., Mel-bourne.**

(Phone FJ 6997 from 10 am to 4 pm), or the Class Manager on either of the above evenings.

AWA

VOLTOHMYST

A56010



WEIGHING ONLY 8½lb, this versatile instrument and its probes will measure all the voltages—r-f, a-f, a-c and d-c—to be found in normal communication, broadcast, or television equipment including the high voltages associated with the cathode ray tube. Further, the load imposed is so small that the voltages indicated are the real *working* voltages.

In addition, direct resistance measurements can be made on all the circuit components—coils, chokes, transformers, and resistors from low ohms to thousands of megohms — plus continuity checks and tests on condensers for leakage. D-C currents can also be measured directly.

Ranges and Facilities

A-C Volts:	0.1 - 1500V (r.m.s. sinewave), 0.2 - 4200V (peak-to-peak) in 7 ranges, 30 cycles to 2.5 Mc; or up to 250 Mc. with crystal probe.
D-C Volts:	0.02 - 1500V in 7 ranges; or up to 30,000V with high voltage probe.
Resistance:	Up to 1000 M ohms, in 7 self-contained ranges.
Current:	0.02 - 1500 milliamps D.C., in 7 ranges.
Mains Supply:	240V, 50-60 cycles.

For more detailed information, write to Test Instrument and Measuring Dept.

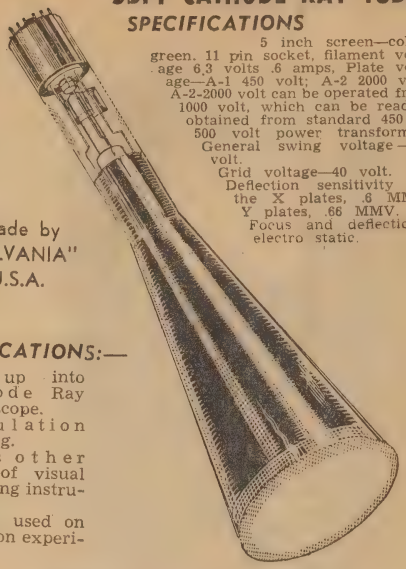
AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED

47 York St., Sydney BO233 | 167 Queen St., Melbourne. MU9161 | Lambton Quay, Wellington, N.Z. 45-076

Waltham's Latest Scoop

HUGE PURCHASE OF

5BPI CATHODE RAY TUBES



Made by "SYLVANIA" U.S.A.

SPECIFICATIONS

5 inch screen—color green. 11 pin socket, filament voltage 6.3 volts .6 amps, Plate voltage—A-1 450 volt; A-2 2000 volt. A-2-2000 volt can be operated from 1000 volt, which can be readily obtained from standard 450 or 500 volt power transformer. General swing voltage — 20 volt. Grid voltage—40 volt. Deflection sensitivity for the X plates, .6 MMV; Y plates, .66 MMV. Focus and deflection—electro static.

APPLICATIONS:—

Built up into Cathode Ray Oscilloscope.
Modulation checking.
Various other forms of visual indicating instruments.
Can be used on television experiments.

PRICE £2/10/- each

Brand new—in cartons.

OXYGEN DEMAND REGULATOR VALVES

Widely used in the U.S.A. by underwater swimmers for constructing DIVING LUNGS. There are several types available, and the conversion details are given in the American Magazine, "Popular Science," July, 1953.

Price: 39/6

Postage and Packing: 3/6. Interstate: 4/6.

"Morse" Buzzer Sets

Consisting of buzzer and lamp. Fitted into compact wooden box, dimensions: 8 ins. by 5 ins. x 2 ins. Can be operated by Morse Key from two torch batteries. Ideal for Scout Troops and amateur radio enthusiasts.

Price: 19/6 Complete with key.

Postage and Packing: 3/-. Interstate: 4/-.

6-power ELBOW TELESCOPES

Use this quality instrument as an astronomical telescope finder, as a spotting telescope, or whenever high or right angle viewing is desired. Also adaptable for telephoto work. It makes looking up or down easy, cuts down eye-strain and fatigue. Can be easily mounted by means of three bolt holes in the mounting plate. You can mount the Elbow Telescope on the gunwale of your boat, or off the end of a dock for viewing the sea bottom. Place a wide shade over the objective end to keep down reflections.

Price: £5

Postage and Packing: 5/-. Interstate: 6/6.

INTERNATIONAL RADIO TUBE ENCYCLOPEDIA

Foreword on how to use book in English, French, Italian, Spanish, Portuguese, German, Dutch, Swedish; Norwegian, Danish, Russian, Polish, Czech, Turkish, Hebrew. Operating characteristics and pin connection of more than 15,000 Valves manufactured all over the world up to 1954.

Price: £3/3/0

Postage: 2/-.

Lightweight (wet) Batteries

JUST THE THING FOR FLOUNDER SPEARING, MODEL AEROPLANES, and any other purpose where a lightweght Battery is required. 2 volt 20 amp hours (as illustrated on right). Made by Exide. In bakelite case, dimensions: 7 ins x 3 ins. x 2½ ins. Weight 4 lbs.

THREE for 30/-.

Packing: 5/-.

We can also supply a larger model, American made, Lightweight aircraft Battery, built into a sturdy metal case. Ideally suitable for caravan lights, yachts, launches. Capacity 24 volt 11 amp hours.

PRICE: £1/19/6.

Packing: 5/-.

LORAN CATHODE-RAY INDICATORS

Type APN.4, Complete with 24 valves, 5CP1 Cathode Ray Tube, and full length Mu-Metal Shield. Ideal for conversion to industrial oscilloscope, also many of the components are suitable for use in the construction of television sets.

Price: £14/19/6

"MARCONI" RADIO TRANSMITTERS

This set is a gift for the "Amateur". Has many useful components. Ideally suitable for stripping purposes. Contains: Two Meters, 0 to 3.5 amps, 0 to 300 mil. (100 mil. F.S.D.); Six separate colour tuning Dials; Six Pointer Knobs; Tuning Condensers; Tuning Coils; Resistors; Condensers, and many other useful components.

Price: £5

FLEXIBLE DRIVING CABLES

As used with American Command and Bendix Receivers. Totally enclosed spring armoured cabling. Ideal for car radio controls, or other similar equipment.

Command Type. Length 6 ft., spline ¼ inch . . . . . £1/0/0 each

Bendix Type. Length 12 ft., spline 5/16 inch . . . . . 35/- each

Postage and Packing: 4/-.
Interstate: 5/-.

ACTUATOR MOTOR

Precision built, 24 volt Motor, with a high reduction gear box, operating an extending telescopic shaft. In-built switching relay controls, micro action switches, and also a thermostatic control. An ideal piece of equipment which can be adapted to operate commercial refrigerator doors and similar equipment, and can also be converted to a 32 volt hand drill.

Price £3/10/0

Postage and Packing: 6/-.
Interstate: 8/6.

ROTARY CONVERTERS

Use standard electrical equipment wherever you are. This Converter will give you 230 volt AC from a 24 volt DC supply. Ideal for equipment using up to 85 watts.

PRICE:

24/32 volt DC . . . £10/19/6

12 volt DC . . . £14/19/6

MOTOR GENERATORS

Hand crank Motor Generator, American made Type GN-35. Can be used to operate as a 6 to 12 volt Electric Motor without alteration. Final drive through reduction gear 200 r.p.m. drawing 5 amps approx. Ideally suitable as driving motor for trawling in small boats on rivers or lakes, duck shooting, etc. Generator rating output: 10 volts at 1.25 amps; 400 volts at .07 amps.

Price: £2/10/0

Germanium Diodes

Have many uses in Crystal Set and Radio Construction.

7/6 each

Postage and Packing: 3/6.

HEADPHONES

High Impedance, suitable for use with crystal sets.

Price: 25/-

Postage and Packing: 3/6.
Inter.: 4/6.

WALTHAM TRADING CO.

MELBOURNE

319-321 Swanston St.
339 Flinders St.
Mail Order Dept.:
PO Box 5234.

SYDNEY

96 Oxford St.
Mail Order Dept.:
PO Box 22, Oxford St.

Oscillator Tracking

(Continued from Page 51)

tance, assuming that, each time the inductance is changed, the trimmer and padder capacitors are readjusted to the predetermined edge or tracking frequencies.

Note that as the inductance gets farther away from its proper value, there becomes only one point of maximum tracking error, instead of two in the ideal case. The new maximum-error point is also shifted in frequency from its proper value.

In some receivers, notably those of the communications type, the oscillator coil is "slug-tuned" so its inductance can be varied for alignment purposes. Normally, this adjustment substituted for the series padder adjustment, so the latter can be made fixed.

However, since there is only one pair of values for inductance and series capacitance which will satisfy the three-point design, the tolerance of the fixed padder capacitor is now the factor governing the maximum tracking error. The variation of tracking by adjustment of L when the padder capacitance is fixed is shown in fig. 7.

It can be seen that for perfect coincidence with the ideal tracking curve (fig. 5) both L and series C, as well as shunt capacitance, must be adjustable. This is seldom done in receivers, except in those in which both amplitude and phase of tracking must meet unusually rigid specifications (such as, for example, receivers used with gonimeters).

Note: (Current practice in Australian broadcast receivers is to use a fixed close-tolerance padder to a predetermined value, usually 425 pf. The inductance of the oscillator coil, governed by the slug adjustment, should automatically approach optimum when used with the specified padder and tracked with an accurately calibrated dial.—EDITOR).

In many selective communications receivers, the signal circuits also have series padders or are slug tuned. This is necessary to overcome manufacturing tolerances in both oscillator and signal circuit components, and provides a high degree of tracking accuracy.

Serviceman Who Tells

(Continued from Page 39)

only assume that the trouble was in the trimmer itself, probably due to a partial short circuit which was sensitive to vibration.

In an effort to confirm this I gave the trimmer a couple of turns and then prodded it again. This time it was perfectly quiet and I had to subject it to considerable abuse before the noise returned. When it did return it was as bad as ever.

The fault was finally confirmed by fitting a new trimmer and subjecting the chassis to a fairly rigorous pounding before returning it to the owner.

As with the first case it would have been easy for me to overlook this fault. Had I not happened to jolt the chassis or had the alignment procedure resulted in a setting of the trimmer which was—temporarily—OK, I might easily have returned the set to the customer with the fault lying dormant and ready to reappear at any time.

Truly, a serviceman's life is full of pitfalls.

Experiments with Ultra-Linear

(Continued from Page 61)

differences in the characteristics of the 6L6 and the EL37. And the main difference is that whereas the first has a Gm of 6, the latter has a Gm of 11.

Unfortunately time has not permitted a complete analysis of ultra-linear behavior on the basis of low-Gm versus high Gm valves, but there is reason to believe that the high-Gm valves will show a higher output power with as low or lower distortion.

SCREEN GM

This is probably because the high-Gm valves will almost certainly have a higher screen Gm, and it is the screen which is the important electrode in this case. The screen Gm has not been considered a very important feature in pentode valves, being more of interest for record and comparison than having a primary value.

But when we connect the screen into the circuit so that it operates not only as a control electrode, but receives negative feedback and also delivers powerinto the load, we at the same time create a rather complex situation in which every electrode has a direct bearing on the valve's characteristics.

The valve in effect becomes a new type, whose behavior merits further study to produce a set of working conditions as a guide to its best employment in the ultra-linear circuit.

If the high-Gm valves do prove to give the same reduction in distortion as the earlier types, but with an output even comparable with that for pentode connection, the case for ultra-linear connection would appear very bright.

In order to examine the point more fully, we intend during the next few weeks to run a series of tests using various screen tappings from as low as 5 pc up to 26 pc, together with distortion, output, and load measurements for various valves in order to form some conclusions on these matters.

SQUARE WAVES

And incidentally, we'd like to reach some conclusion about how good an amplifier need be to be good enough. All practical design must be a compromise, and we must remember the poor fellow who has to pay up for the end result.

Particularly would we like to know how closely a square wave can be approached when reproducing music. If its not very close, then we might have to recast our ideas of the value of such tests. In the meantime, they are very useful in analysing what goes on in the upper registers.

We would like to acknowledge with thanks the co-operation and courtesy of the Amalgamated Wireless Valve Co. for their assistance in making distortion tests in connection with these experiments, and to the various transformer manufacturers, all of whom have been most helpful in making up output transformers for them.

Next month we hope to continue the discussion on ultra-linear operation and its application to transformer design.

GEASA

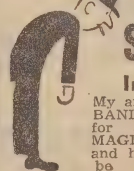
It was a wise King of Ireland who covered his head to prevent the early morning sun from shining on him in his bed at Tara. If he didn't it was Geasa — and that means lots of bad luck. It was even worse if he got off his horse in Bregia on Wednesdays; worse still if he started a war on Tuesdays; but absolutely hopeless if he boarded a ship on Mondays.

Being a King in those parts in the far ago was not all beer and skittles. Too many restrictive days. Not like Radio men in this Country — or any other country in the world. They buy and use Morganite Resistors and Potentiometers on any day except Sundays, and have good luck with them ALL the time. After all, it's performance and long life that count, and these moderately-priced units definitely ensure that.

(See Advertisement on page 68)

THE MORGAN CRUCIBLE
Co. (Aust.) PTY. LTD.
65—67 Bourke Road,
Alexandria, N.S.W.
Phone: MU1371

SMOKING got you down ?
Now there is an easy way for you to conquer smoking before smoking habit has a chance to conquer you.

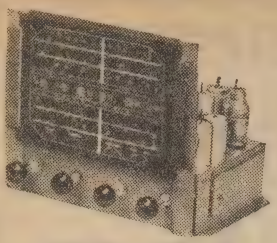


STOP SMOKING
In 1 Day or Less
My anti-smoking discovery BANISHES your craving for smoking. Acts like MAGIC. Improves appetite and health. Save money; be pounds in pocket. Thousands cured. Inexpensive, speedy and success GUARANTEED.

WRITE FOR FREE BOOKLET
Send for FREE BOOKLET, "How To Stop Smoking", with instructions and special application form. Send at once, enclosing name, address and 2 stamps for postage.

JACK ELWOOD, Dept. RH1/5,
Box 2444, G.P.O., SYDNEY.

SONGSTER REG'D
PICK-UP & PHONO NEEDLES



NEW RADIOGRAM-CHASSIS

(DUAL-WAVE) FULLY GUARANTEED

These chassis give excellent local, interstate and overseas reception, and are fitted with pick-up terminals and radiogram switch. On-off switch is fitted to enable power to be switched off from set.

£17/17/6

PACKING and FREIGHT EXTRA

Supplied tested and complete in every detail with five standard valves, 6J8G, 6SK7G, 6SQ7G, 6V6G, 6X5G, and 12in Rola or Magnavox speaker.

GRIMES ELECTRIC MOTORS

MADE IN U.S.A.
24 Volts D.C., 1.25 amps.

Reversing connections. 11 segments commutator, with gearbox 3 x 3¾ x 2 inches. Supplied complete with reduction action gearbox to approx. 100 R.P.M., also automatic electric brake for quick stopping. May be used without gearbox where required.

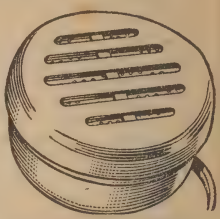
PRICE 37/6 each

Packing & Postage, 2/- extra.

PILLO-FONE EXTENSION-UNIT

IT'S A REAL MINIATURE WITH ROLA UNIT

Install it anywhere, in the sick-room, workshop, garage or any room in the house. Just connect across voice coil of the existing speaker. The "PILLO-FONE" IS THE MOST CONVENIENT LITTLE UNIT YET DEVISED. 3¾in Diameter by 1¾in deep. POST FREE. **22/6**



COMMAND RECEIVERS Q.5ERS

New command receivers freq. 190 to 550kc., complete with six valves.

£8/17/6 PLUS POSTAGE

NEW RELAY-TYPE COUNTERS

These Electronic Counters counting from 0 to 9.999 have a 250 ohm coil

Supplied in brocaded finished box complete with rectifier and transformer for 240v AC operation. **£2/5/-**

Plus post.

NEW MAIL ORDER SERVICE

For the convenience of our Country and Interstate customers we have reorganised our mail order department and can now guarantee despatch of goods within 48 hours of receipt of order.

PLEASE PRINT NAME AND ADDRESS CLEARLY ON ALL CORRESPONDENCE.

22/- PLUS POSTAGE

NEW ACMA "SPORTSHOT" CAMERAS

These streamlined design, precision built cameras in durable plastic, feature precision finished lenses, shoulder strap in matching colour, dual spool adaptor takes 120 or 620 film, finger tip spring return shutter control, direct vision eye level view finder. Takes eight pictures 3½ by 2½ on 620 film.

HIGH FREQUENCY TEST EQUIPMENT

H.F. WAVEMETER

TYPE A.B.W.I.

Complete with O-1 ma meter 2 1P5 and 1-958

£6/17/6 F.O.R.

F.H. TEST SET

Comprising Signal Generator, 100 to 150 MC and Field Strength Indicator with Meter.

£14/10/0 F.O.R.

NEW AMERICAN WALKIE-TALKIE CHASSIS

Type SCR-536 less valves, case, crystal. Valves used 2.354, 1.1T4, 1.1S5, 1.1R5 3S4. **£7/10/-**

METROPOLITAN RADIO SUPPLIES

479 Parramatta Rd., Leichhardt, N.S.W.
(At top of Taverner's Hill)
PHONE LM3610

NEW UNIVERSAL-MULTIMETER

Manufactured by Robinson Electronic Laboratories
Incorporating 4½in world famous American Weston Meter

This high-grade instrument is fitted in a durable and attractive Hammertone-finished case with self-contained batteries and supplied complete with test prods.

D. C. Ranges	A. C. Ranges	D. C. Current Ranges	Resistance Ranges	Output Ranges	PRICE
O-12V	O-12V	O-1.5MA	O-5,000 ohms	O-12V	£12/17/6
O-60V	O-60V	O-12MA	O-50,000 ohms	O-60V	Plus 12/6 PACKING & POSTAGE
O-300V	O-300V	O-60MA	O-500,000 ohms	O-300V	
O-1,200	O-1,200V	O-300MA			

Also Decibel Scale—18 to plus 5D.B.

NEW ENGLISH CONRAD RECORD PLAYERS

SINGLE SPEED 78 RPM RECORD PLAYER FITTED WITH HIGH FIDELITY ACOS PICK-UP AND AUTO-STOP **£3/8/6**

FREE 3 ROTHERMEL SAPPHIRE NEEDLES SUPPLIED WITH EACH PLAYER, SUFFICIENT FOR 6000 RECORDINGS

Plus Postage
Interstate — 8/6.
N.S.W. — 5/6

NEW VALVES

12H7 .. .. 7/6	6SJ7 .. .. 12/6	866 .. .. .. 20/-
12A6 .. .. 12/6	6K7G 8/6	813 .. .. .. 60/-
12SL7 .. .. 12/6	6U7G 12/6	809 .. .. .. 30/-
12SJ7 .. .. 12/6	6SA7GT .. 12/6	EBF35 .. .. 15/-
12K7 .. .. 12/6	6SQ7GT .. 12/6	VR99 .. .. 15/-
9001 .. .. 10/-	6SN7GT .. 10/-	954 .. .. 10/-
9004 .. .. 10/-	6SH7 .. .. 7/6	6SH7 in dozen
AV11 .. .. 9/9	7193 .. .. .. 5/-	lots each .. 5/-
1K7G 9/6	1T4 .. .. . 15/-	1K5 in dozen lots
1M5G 9/6	VR65A 3/6	each 2/6
1C7G 11/6	6AG7 .. .. 12/6	EL33 .. .. 12/6
1L5G 10/6	1K5 .. .. .. 3/6	6J7S 12/6
85 .. .. .. 5/-	807 .. .. .. 22/6	6J6 .. .. . 15/-

Please add postage

New Electrolytic Condensers

12 mfd-525V **4/6** each or **48/-** dozen plus post
8 mfd-350V **2/6** each or **24/-** dozen plus post
4 mfd-600V **2/6** each or **24/-** dozen plus post
16 mfd-350V **3/-** each or **30/-** dozen plus post
10 mfd-40V **2/-** each or **21/-** dozen plus post

NEW GERMANIUM DIODES TYPE 4A42

Ideal for use as Crystal Detectors, Noise Suppressors, etc **7/6**
POST FREE

CERAMIC VARIABLE TRANSMITTING CONDENSERS

(Suitable for conversion to split-stator).

100pf. double spaced **12/6**
60pf. double spaced **10/-**
30pf. double spaced **10/-**

CERAMIC TRIMMER CONDENSER

7-plate silver-plated miniature variable condensers approx. 30pf. screw-driver adjust, with locking screw. **4/6** plus postage.

METROPOLITAN RADIO SUPPLIES

479 Parramatta Rd., Leichhardt, N.S.W.
(At top of Taverner's Hill)

PHONE LM3610

NEW I.R.C. RESISTORS

I.R.C. Carbon resistors ½, 1 & 2 watt in values 50 ohm to 2meg. including many popular sizes: 3T, 15T, 25T, 35T, 50T, 100T, 250T, 500T, etc. **In Boxes of 100, 25/-**

Standard Resistor and Condenser Colour Code Card Supplied with Resistors.

CARBON RESISTORS

Well known make of carbon resistors in values of 100 ohms to 5 megohms. In 1-watt, ½-watt and 1/3 watt. All resistors are standard colour coded and in original cartons. In lots of 100 mixed values comprising 50 1-watt, 25 ½-watt, 25 1/3-watt .. Post, 1/6. **12/6**

IN LOTS OF 500, 50/-.

Standard Resistor and Condenser Colour-code card supplied with resistors.

ROTHERMEL SAPPHIRE NEEDLES

Made in England
PLAYS 2000
RECORDINGS, ea **5/6**
List Price 13/-

NEW MERCURY SWITCHES

The switch with a 1000 uses.

2/9 Each

CONDENSER SPECIAL

Boxes of 100 new mica and paper condensers in values ranging from 50pf mica to .5 400v papers. Each box includes .0001, .00025, .00075, .001, .008, .02, .05, .1, .5 etc. **Price 30/- per 100**

NYLEX HOOK-UP WIRE AT HALF-PRICE

Nylex hook-up wire 10/.010 in 100 yard coils, each coil consisting of five 20 yard lengths in 5 different colours.

10/- PER 100 YDS. Plus postage.

NEW POTENTIOMETERS

1 Meg or ½ Meg double pole switch pots. 2½in spindle **6/6**
½ Meg or 25T ohm switch pots, double pole 1in spindle **3/6**
1 Meg or ½ Meg pots. 2½in spindle .. **4/6**
½ Meg pots 1in spindle **2/6**

SMALL 24-VOLT AC/DC MOTORS

29/6 PLUS POSTAGE

AMERICAN ANTENNA SWITCHING MOTORS

Complete with 8 Pye-Type Co-ax Bases, R.P.M. 1750, Ball Bearing.

AMERICAN REDMOND BLOWER MOTORS

Ball-bearing, fully laminated, 6000 R.P.M., 1 amp spindle $1\frac{1}{4}$ x $\frac{1}{4}$. Complete with blower, new in carton.

45/- PLUS POSTAGE

39/6 PLUS POSTAGE

Small 24v ball-bearing motor. Reversible, fully laminated, approx 1/15H.P

Size $3\frac{3}{4}$" x $2\frac{1}{2}$" with $\frac{1}{4}$" diameter shaft.

New Transformers Suitable For All Above Motors to Operate off 240v A.C. 30/- ea. plus postage.

Heavy Duty Genemotor

Suitable for conversion to A.C. motor (approx. one sixth H.P.) Fully laminated. Can be used as 6 or 12 volt generator at 20 or 13 amps £2/17/6 f.o.r.

NEW-AMERICAN TELEPHONE WIRE

Rubber insulation with stainless steel and copper conductors supplied on metal reels each containing half-mile of wire. £1/15/- per reel. Case lots, each containing six reels (three miles of wire) .. ..

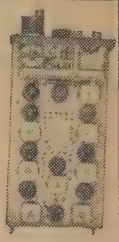
£10 PER CASE F.O.R.

AMERICAN H.F. RECEIVER ASB

Complete with 11 tubes, 7 6AC7, 2 6H6, 2 955 Acorns. Can be altered to 144 or 280 Mc amateur band or FM band.

£5/17/6

PLUS POSTAGE.



NEW AMERICAN INDICATOR-UNIT

These indicator units contain the following valves:—

Six 6SN7GT, one 6G6, one 6H6, one 6X5GT, one 2X2 and 3BP1 C.R.O. tube which is fitted in a separate shield on a 4ft shielded lead and supplied with control box and plug; case and shield are finished in black brocade. In original cartons.

£10/17/6

F.O.R.

TRANSFORMER TO CONVERT THIS UNIT FOR 240 VOLT OPERATION AVAILABLE AT £3/15/- EXTRA plus postage.

240 VOLT POWER TRANSFORMERS AND CHOKES

2000 x 2000v at 600ma.
1500 x 1500v at 700ma.
750 x 750v at 750ma.
240 to 110 at 8 amps.
240 to 110 at 8 amps. auto.
Above transformers £7/10/- each. F.O.R.

425 x 425 at 150ma. £2/18/-
265 x 265 at 250ma. £2/5/-
365 x 365 at 150ma. £2/5/-
285 x 285 at 150ma. with 5v2amp and 6.3v4amp. fil. windings (standard) £3/5/-
285 x 285 at 60ma. with 6.3v at 3amp. fil. £1/18/-

HIGH VOLTAGE TRANSFORMERS
Primary 240v. Sec. 4,250v tapped at 3,400 and 2,500 .. ..£4/10/-

CHOKES
600ma. £2/10/-; 150ma. £1/10/-, 100ma. 15/-, 60ma. 13/-. Freight extra on all transformers and chokes.

NEW--DYNAMIC--SPEAKERS

New 7in dynamic speaker by leading manufacturer 1500 ohm field coil, 7000 ohm transformer .. ..
New ovaltone dynamic speakers 9in x 6in 1000 ohm field and 5000 or 7000 ohm transformer .. .. ..

27/6
27/6

SPECIAL PRICE FOR QUANTITY
Postage N.S.W. 3/6
Interstate 5/6
POSTAGE AS ABOVE

MIDGET GENEMOTOR

Input 28 to 32 volt at 1.1 amp output 250V at 60 MA.

New in carton.
£2/15/-
Used but in good order
£1/18/6

Input filter supplied with genemotors

Postage extra

METROPOLITAN RADIO SUPPLIES

479 Parramatta Road, Leichhardt, N.S.W.
(At top of Taverner's Hill)
PHONE LM3610

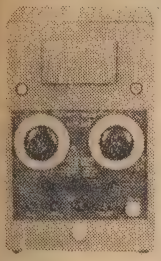
OIL FILLED CONDENSERS

2mfd. 1800V **17/6**
4mfd. 200V **4/6**
15 mfd—600V **12/6**
20mfd. tapped 600V **15/-**
1mfd. 600V **5/-**
.5mfd 2500V **6/6**
.25mfd. 3000V **6/6**

Postage extra

A.R.8—COMMUNICATIONS—RECEIVERS

Converted for 240v. AC operation



Including power supply, 9" x 7" ovaltone speaker

A.P.8 receivers are manufactured by A.W.A. and have a continuous coverage from 140 K.C. to 20 M'CS in six switched bands. Set contains 13 valves as follows: 3-6A8G, 4-6U7G, 2-6V6G, 1-6B8G, 1-X5G, 1-6V4, and 1-6J7. Receiver, speaker and power supply are fitted in attractive and durable plastic-covered instrument case which makes this unit complete and portable. On/off switch and tone control are also fitted.

£34/17/6
F.O.R.

UNCONVERTED AR8

Supplied with valves (11) power supply lead and plug. **Air Tested £23/17/6 F.O.R.**

Supplied less valves and covers with power supply lead and plug. **£9/17/6 F.O.R.**

A.C. POWER-SUPPLY FOR AR8

240 volt A.C. power supply for use with any A.R.8 receiver. Supplied in brocaded finished case, with standard A.R.8 power supply plug fitted. Ready to plug into your receiver. Output 250v at 125MA. with 12 and 6v filament windings.

£7/17/6
F.O.R.

Circuit supplied free with all A.R.8 receivers

A.T.5 TRANSMITTERS

A.T.5 Transmitters supplied complete with valves (3-807 and 2-6V6), plug and circuit

Price **£9/7/6**

A.T.5 Transmitter less valves.
With circuit **£5/5/-**

A.T.5 Transmitter less valves and covers.
With circuit **£4/5/-**

HIGH-POWER I.R.C. RHEOSTATS

250 ohm, 25 watt.
10 ohm, 2½ amp; 25 ohm, 1 amp
Price, each **10/6**

CRYSTAL PICK-UP CARTRIDGES

Rothermel high fidelity pick-up cartridges, replacement for most pick-ups.

10/6 each.

BUTTERFLY CONDENSERS

Capacitance range 3-35 microfarad. Size 1½ x 2¼ x 2¼ inches. brass plates: Ultra high frequency insulation: ¼ inch shaft.
Price, each **7/6**
Packing and postage: NSW, 1/-; Q., T. and V., 1/6; W.A., N.T., 2/-.

New A.W.A. VIBRATORS

6 volt A.W.A. gas filled vibrators, heavy duty, synchronus.
Price **15/-**
(Special price for quantity.)

D.C. GENERATORS

12V 750 watt Ideal Home Lighting Battery charging, etc.

PRICE £3/10/- F.O.R.

TRICKLE-CHARGER KITS

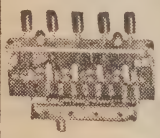
Kits for trickle-charger as described in R. & H., June issue. Comprising transformer with 18V winding tapped at 12V-3 100mA rectifiers and 50 ohms control.
Postage: NSW, 5/-; Interstate, 7/6. **39/6**

NEW COSSOR C.R.O. TUBES

Ideal for oscilloscopes or TV sets.

VCR97 6in Tube **47/6**
VCR138 3in Tube **42/6**

PUSH-BUTTON SWITCHES



5-pole each 2 pair of contacts. Made in USA. Ideal for receivers, multimeters, etc.
Price Each .. **12/6**
Packing and postage: NSW 9d., Interstate 1/6.

A.T.5-A.R.8 POWER SUPPLY

24 volt genemotors supply containing two genemotors, one giving 550 volt at 350 mills and the other 250 volt at 100 mills, also contains filter condensers, relays, fuse holders, etc.

£4/10/- **F.O.R.**

TYPE 1133 TRANSCEIVER

Freq. range 90 to 130 m/cs contains 17 6.3 volt valves.

£8/17/6

METROPOLITAN RADIO SUPPLIES

479 Parramatta Road, Leichhardt, N.S.W.
(at top of Taverner's Hill)
PHONE LM3610

NEW 4 INCH PRECISION SPIRIT-FILLED COMPASS

Complete with corrector **17/6**

Postage 5/- extra

NEW MN26 COMPASS CONTROL-BOX

37/6

23 pin plug for MN26 compass, 37/6.
18 pin plug for MN26 control box, 25/-.
6in Flexible drive for above, 10/-.
24in, 18/6.

Postage extra.

SPECIALS

New Dynamic Mike-Inserts .. 8/6
Bakelite Fuse Boxes 4/6
5-Position Push Button Switches 12/6
Carbon Mike Trans. 4/6
Throat Mikes 5/-
Cutler Hammer Switches 2/6
Shielded Hook-up Wire, yard .. 8d
3 gang Standard Condenser .. 20/-
2 gang Condenser 16/-
Miniature-Wafer-Switches 4 pole 3 position. New 6/6

NEW WESTON & FERRANTI METERS

0-.5 amp. RF thermocouple 9/6
0-3 amp. RF thermocouple 9/6
0-4 amp. RF thermocouple 9/6
0-10mA DC 17/6
0-5 amp. DC 27/6
0-10 amp. DC 27/6
(All above are 2in flush mount.)
0-10mA DC English Turner 3in Round Flush Mounting 25/-
Postage Extra.

MOTOR SPARES LTD

A B C D E F G H

WIRES & CABLES

A. 3-core Shielded Cable, cores rubber covered and different colors tinned copper outer braiding. **1/6** yard.
B. Coaxial Cable, solid polystyrene insulation copper braided with black plastic outer insulation, 70 ohms impedance **2/3** yard.
C. Coaxial Cable, beaded insulation tinned copper braid and lacquered cotton outer insulation approx. 70 ohms impedance. **2/-** yard.
D. Heavy 2-core Shielded Cable, rubber cab tyre interior, empire taped and tinned copper outer braiding. Will stand high voltage. **2/-** yard.
E. Medium 2-core Shielded Cable rubber insulation empire-taped and tinned copper outer braid. **1/3** yard.
F. Medium 2-core Shielded Cable rubber insulation empire-taped and tinned copper outer braid. **1/-** yard.
G. Heavy single core Shielded Cable rubber insulated, empire-taped with tinned copper outer braid. **1/-** yard.
H. Light Belden single core Shielded Cable with lacquered woven cotton outer insulation. Ideal for microphone cable. **9d.** yard.
J. 7-core Plastic Insulated Cab-tyre Cable with rubber outer insulation. **1/6** yard.
K. 5-core Rubber Insulated Cable Cotton lacquered outer insulation, **1/4** yard.
L. 2-core Heavy duty rubber and cotton insulated cable, suitable for lighting plants, car wiring, etc., **1/-** yard.
M. 5MM Rubber covered ignition cable. **6d.** yard.
N. Single Core multi-strand copper wire, plastic insulated cable, with lacquered cotton woven outer insulation for car wiring, radio work, etc., will carry 7 amps. **4d.** yard, 100 yard reels **25/-**.
O. 7-core Cable each core contains 13 strands wire and has plastic insulation all covered by lacquered cotton outer insulation. **1/6** yard.
P. Heavy Duty 7-core Cable similar to type O, but each core has 19 strands wire. **1/9** yard.

733D AIRCRAFT RADIO RECEIVER

Brand new B.C. 733 D Aircraft Radio Receiver.

An U.H.F. receiver complete with Genemotor to operate from 24/28 volts D.C. It employs a crystal controlled oscillator and operates on any of six frequencies from 90 to 120 megacycles. Tubes — 3-717A (V.T.269) 2-12S.G7, 1-12A.H.7, 2-12SR7, 1-12SQ7, 1-12A6.
Price with Genemotor **£12/10/-**
less Genemotor **£10**

(Type R89)

A.R.N.5 RADIO RECEIVERS

Operates on either 332.6, 333.8 or 335 megacycles. The operating frequency is changed by changing the crystals. Complete with 3 crystals 6597.9, 6522.92 and 6547.92 K/cycles. It is designed to operate from short straight dipole antenna and balanced transmission line. Tubes used 2-12SN7, 7-6AJ5, 1-12SR7, 1-28D7.
An external power supply is required to operate. Easily modified for use as a Television U.H.F. Converter. Brand new with Handbook **£15/10/-**

NOTICE
All Parcels sent Registered Post unless otherwise stated. Freight must be included with orders.

SPECIALS

1. IH4Gt Valves brand new and boxed. Suitable for Detector & Amplifier or Battery operated radios using 1½ or 2 volt A. Battery.
Usual price 21/-
Our price 5/9
2. A few only MN26C Radio Compass Receivers. Frequency 150 to 1500 K.C. with built in genemotor to work off 28 volt DC supply 12 metal 6 volt valves are used and this set can easily be converted to 12 valve communication AC radio receiver.
Price with valves **£17/10/-**
Price less valves **£10/10/-**
3. Condensers .001 Block type 5000 volt working, suitable for R.F. These are brand new and were made for Royal Navy.
Our price only **5/-** each.
4. Metal Boxes with lid. Ex-army, these were spare parts boxes. Small quantities only.
Size 8½ x 4½ x 2½ inches 2/9
10½ x 4½ x 3 inches 3/3
9 x 7 x 4 inches 4/6
9½ x 8 x 7 inches 6/6
6 x 6 x 6½ inches 3/9
5. Rotary Converters 24 volts DC input, 230 volts, 50 CPS A.C. output at 125 Watts new condition. Works well off 32 volt light plant. Price only **£14/10/-**.
6. Radio Transmitting Crystals in sealed bakelite holder. Frequencies available 2117.5, 3150, 4185, 4192.5, 4228.3, 4235, 5615, 5646, 5646.6 KC. **35/-** each.
7. Crystal Microphones made by Geloso of Italy.
Type U N 10 Insert in metal case **30/7**
Type M409 Insert in rubber case **32/11**
Type M410 Complete metal case, suitable for hand microphone **38/6**
Solder 1lb reels resin cored excellent solder 50/50.
Worth 17/6. Our price **9/6** each
8. Brand new record players in leatherette covered case. Well known make of 3 speed motor with twin needle crystal head. Ideal for microgroove or standard records. Available in fawn or brown colors. Worth £17/10/-. Our price **£12/10/-**.
9. Padder Condensers. Suitable for 455KC oscillator circuits adjustable. Worth2/9. Our price **1/3.**
10. 3 Speed Gramophone motors, well known English make with heavy turntable, adjustable knob, changes motor speed to 33, 45 or 78 rpm. Ideal for playing all kinds of records.
Worth £8/10/-. Our price **£5/10/-.**
11. Spring Gramo. motors. This excellent wind-up motor is suitable for replacement in portable gramophones or combined portable and gramophone. Complete with turntable and fittings.
Only **£3/10/-.**
12. Type A1052 Transceiver Eureka Mark 2. Few only left, this UHF Transceiver has five spot frequencies, uses the following valves. 3-RL18, 5-EF50, 1-VR92, 1-6H6, 1-CV66. The Transceiver operates on a built in power supply requiring a 12 volt DC battery. Price equipped with Valves in new condition **£13/10/-** each.
13. 60 watt output transformers 3800 CT primary suits pair of 6L6G or 807 class AB 2 etc to 300, 250, 125 line. Brand new.
Worth £9/5/-. Our price **£5/10/-**
14. Microphone Adaptors M299 designed to adapt magnetic throat microphone to amplifier. Price **5/-.**
15. AT300 Transmitters. Radar transmitter uses the following:— 2-AV11 valves, 2 cyclotron valves, 2-4 pin ceramic sockets, 1-24 volt motor with cooling fan, 2-.01 5000 volt wkg. condensers, 1-.02 10,000 volt wkg condensers, 1-.001 5000 volt mica condensers, 3 heavy duty transformers, 1- 0-100 volt AC meter which is a 1 ma DC movement with 1 ma dry metal rectifier fitted 1- 5 ma DC meter and many other parts.
Price only **£3/19/6.**

547 ELIZABETH ST., MELBOURNE ALSO AT — ALBURY ARARAT BAIRNSDALE BALLARAT
BENALLA BENDIGO BROKEN HILL COLAC DANDENONG ECHUCA SALE FRANKSTON
GEELONG MILDURA SHEPPARTON ST. ARNAUD WAGGA WANGARATTA WARRAGUL

ANSWERS TO CORRESPONDENTS

T.McG. (Moorooka, Q.) writes to tell s how much he likes Radio and Hob-ies and explains that he is keen to art building sets. He also wants to now whether we have ever described he construction of a dry battery charger nd whether it would be possible to use simple welding outfit for soldering in adio construction.

A. Many thanks for your comment, McG., and we hope the magazine will ontinue to please you. We think you ill find the construction of receivers very interesting pastime. Strictly peaking it is not possible to recharge he so-called "dry" battery and thus here is no such thing as a dry battery harger. However, it is possible to re-ctivate such batteries and increase heir life considerably and we described uch a unit in conjunction with the ambler portable (October-November, 953. It might be possible to use the elding device for soldering in an mergency but we doubt very much hether it would be satisfactory for full me use in radio construction. We sug-est one of the quick heating type irons a six volt supply is all that is avail-ble.

B.J. (Concord West, NSW) writes to ongratulate us on the various begin-ers' articles and to tell us that he and s friends have derived a lot of pleasure om them. He is particularly interested the DX Junior of the October issue. t points out that he and most of his iends have acquired modern miniature rts while following the recent articles nd he would therefore like a similar t but designed to use these parts.

A. Many thanks for your comments, J., and we are glad to learn that the agazine has proved so useful. Thanks so for the suggestion regarding the use miniature components and we will ve this idea some serious thought. In meantime we would refer you to the hree Band Three of February, 1951, hich is along somewhat similar lines. In he matter of battery sets the Three alve Set of February, 1953, may prove teresting.

R.L. (Claremont, WA) writes to ask ur advice on a proposed method of achieving bandspread in a communication receiver. Briefly the idea is to provide separate controls for the oscillator circuit and the RF stages, the latter being ganged together. The oscillator will use a two gang capacitor, one having normal capacitance for general coverage and the other one only a few plates to provide ham band coverage.

A. There would appear to be no serious objection to the idea, provided the need to tune the two sections of the set separately is not an objection. Assuming the RF dial is calibrated with reasonable accuracy it should be possible to track the two controls manually, with sufficient accuracy to enable the wanted station to be found. After that the RF stages may be adjusted for best signal strength. Whether the ratio you have selected for the bandspread idea is sufficient will depend mostly on your own requirements and we can only suggest that you try it and modify it if necessary.

R.E.P. (Essendon, Vic.) wants to use an electro-magnetic speaker with the DX Junior and would like to know how to fit it. He also asks for a circuit of a small amplifier for microphone and pick-up work.

A. Sorry, R.E.P., but there is no easy way in which you can use your speaker with the DX Junior. Normally the current drawn by the set is made to flow through the field winding, thus filtering the current and energising the winding in one operation. This is only possible if the voltage is initially high enough to allow for the voltage developed across the winding and if the current drawn is sufficient. In this set neither condition could be fulfilled and a separate power supply for the speaker would be necessary. This is not likely to be attractive by reason of the extra cost and complexity involved. For an amplifier to suit your requirements we suggest the GP Junior described in the October issue. Many thanks for your comments about the magazine and we hope it will continue to help you.

G.G. (Brunswick, Vic.) is anxious to use an RF power supply in conjunction with his 5in CRO and wants to know what shielding precautions will be necessary.

A. We doubt whether you will encounter very much radiation trouble from such a supply and it should be reasonably easy to shield it by enclosing it in a metal box and by by-passing the various leads which enter the box. However, we suggest that you try the power supply without such elaborate precautions first, since it may transpire that they are not needed. A much more likely source of bother will be magnetic fields from the power transformer.

L.V.C. (Concord, NSW) says he is a keen and appreciative reader of Radio and Hobbies. He would like to see published articles on automotive test equipment, if only describing the principle of operation.

A. Thanks for your letter, L.V.C., and for your kind remarks. Many other readers have made the same request and we will try to get around to it just as soon as possible.

M.V.M. (Lyndock, SA) is worried by the needle chatter which occurs in his crystal pickup and wants to know if there are any circuit modifications which would cure it.

A. Sorry, M.V.M., but there is no simple cure in the manner you suggest. The effect is purely acoustic and is caused by the normal vibration of the stylus. Some pickups are much worse than others in this respect, but all will show it to some extent. The best cure is simply to enclose the turntable and pickup in a box or cabinet, lining this with felt, if necessary, to remove the last trace of the trouble.

D.O.E. (Yallourn, Vic.) comments on the question raised by C.J.T. in the September issue regarding the connection of a horn speaker to a crystal set. He forwards a circuit of a simple one valve amplifier, which he suggests might solve the problem. The amplifier consists of an audio transformer with the primary winding connecting to the headphone terminals of the crystal set and the secondary to the grid and filament negative terminals of a valve. The valve suggested is a 1B6 or a 1D6 but almost any battery triode could be used. The filament supply is selected to suit the valve and the HT is a nine volt "C" battery.

A. Many thanks for the circuit, D.O.E., and, as you can see, we have described it above for the benefit of C.J.T., if he should see it. Unfortunately we cannot reproduce it but the above description should give the general idea of the scheme.

R.S. (5 Gleeson Av., Burwood, E13, Vic.) wants to know if we can help him find the data for a DeForest triode type DV5. He also inquires about the publication date of the article on Electro-Flash.

A. We are afraid we cannot help you in the matter of the triode, R.S., and can only suggest that some reader may be able to supply the information. Several articles have appeared on the construction of Electro-Flash units, the high voltage version being in August and November, 1952, and the low voltage version being in April, May and June, 1954. The fitting of a second gun to these units was described in the October, 1954, issue.

J.O.R. (Mosman, NSW) sends us details of a rather elaborate shortwave receiver which he recently built and which he suggests may be of interest to other readers.

A. Many thanks for your contribution, J.O.R., and we have filed your circuit for possible use in the Reader Built It section of the magazine at a later date.

THE "RADIO & HOBBIES" QUERY SERVICE

ALL queries concerning "R & H," designs, to which a POSTAL REPLY is required must be accompanied by a postal note or stamps to the value of TWO SHILLINGS.

For the same fee, we will give advice by mail on radio matters, provided the information can be drawn from general knowledge. UNDER NO CIRCUMSTANCES, however, can we undertake to answer problems involving special research, modification to commercial equipment or the preparation of special circuits.

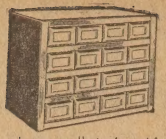
Whatever the subject matter, we must work on the principle that a letter is too involved if the reply takes more than 10 minutes of our time.

Queries not accompanied by the necessary fee will be answered FREE in the columns of the magazine and presented in such a way as to be of interest to others readers.

To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three "R & H" constructional projects. Scale blueprints showing the position of all holes and cutouts in standard chassis will now be 4/6. These are available for nearly all our designs but please note they do NOT show wiring details.

Address your letters to The Technical Editor, "RADIO and HOBBIES," Box 2728C, GPO, Sydney.

Note that "RADIO & HOBBIES" does not deal in radio components. Price quotations and details of merchandise must be obtained direct from our advertisers.

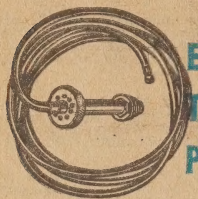


Small Parts Cabinet

16 drawer all-steel cabinet for storing small parts, tools, nails, screws, bolts, etc. Each drawer is 1½in x 2½in x 5½in in size. Will hold parts or tools up to 5½ inches in length. Identification cards can be fitted on each drawer. Strongly made and most useful. Attractive appearance and finished in baked enamel. Keeps your workshop tidy. Saves time searching for lost parts, etc. Ideal for motorists, mechanics, hobbyworkers, garages, shops, etc. Price £3/15/-, post free.

Brake Re-lining Tools

Set of four tools, comprising chisel for cutting head of old rivet, punch for removing old rivet, punch for driving in new rivet, and a countersinking punch. These tools are specially designed for brake re-lining. They do a first class job quickly and easily. Complete set, including leather case. Price £1/17/6, post free.



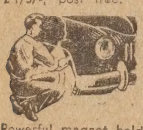
ENGINE TYRE PUMP

End back-breaking labour of pumping tyres

Just remove a spark plug and screw engine pump into plug hole. Start motor and your tyres are inflated in a jiffy. Fits any size plug hole. Suitable for all makes of cars, including Big American Cars, trucks and tractors. Inflate your tyres the easy way. Engine pump complete with 15 feet of hose . . . Only £3/18/6, post free. State plug size.

Sensational Car Sponge

Connects to any garden hose. Water flows through the sponge, thus washing dirt away, and keeping the sponge clean all the time. Wash your car the quick, easy way. Simply wipe car with sponge. Gives clean and shiny finish. It's so labour saving. No drying or polishing required after washing. This fine quality sponge will never scratch your car. Send today for your car sponge and enjoy the pleasure of this improved method of car washing. Can also be used for washing windows and paintwork on your home. Price £1/5/-, post free.



Magnetic Trouble Lamp

Powerful magnet holds lamp to any part of car body, engine or chassis. Just the lamp for night breakdowns or changing tyres in the dark. Works off car battery. Won't scratch bodywork. Supplied complete with flex and battery clips. Price £1/15/-, post free. Please advise voltage required.

Pinking Shears

Very useful for sewing. Gives your dress-making that professional look. Best quality imported pinking shears, 7½ inches in length. A most useful present for Mother. A gift that will delight her. Price £2/15/-, post free.

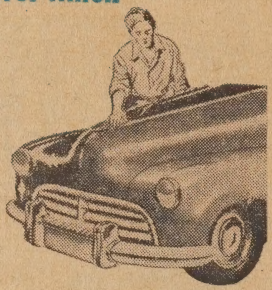
The accessories and tools advertised are quality lines that will give you BIG savings. Efficient after sales service. Read the service you are guaranteed:—

★ Every accessory and tool is guaranteed for two years.
Written money refund guarantee supplied with every order.

Perfect auto paintwork

yet not a spray job.

no brushing
no spraying
no brushmarks
no lapmarks
no streaks
mirror finish



A Sapphire painted car looks like a spray job, is as good as a spray job, yet only costs a fraction of the price of spraying.

In America, thousands of motorists paint their cars with a factory finish type of enamel applied with a special applicator. Dollars are scarce, but you can now get genuine **Sapphire Enamel** from Pacific Auto Supplies.

This amazing enamel paints your car **without leaving a single brushmark!** You will be delighted with the high gloss mirror finish of your car. You will be thrilled with its smart appearance. You will be pleased at the huge savings.

The application is simplicity itself. Just clean grime and wax off car, then wipe on the enamel **with the special applicator supplied.**

No need to remove old enamel. One quart covers a car, including American cars. One coat is sufficient. Goes over any old enamel or lacquer.

Guaranteed **not to leave brushmarks, streaks or lapmarks.**

Guaranteed not to chip, peel, fade or crack for two years.

You get a **written two year guarantee of satisfaction** with every tin of Sapphire.

You can't lose on Sapphire. If it fails to please, you get your money back.

28 BEAUTIFUL COLOURS

White.	Mid stone.	Dove grey.
Off White.	Fawn.	Dark grey.
Ivory.	Pastel green.	Mail red.
Cream.	Light green.	Cherry red.
Light. Cream.	Lawn green.	Russet red.
Rich cream.	Dark green.	Maroon.
Light stone.	Grey green.	Dark maroon.
Yellow.	Light blue.	Chocolate.
Black.	Royal blue.	Sky blue.
	Navy blue.	

One quart of Sapphire Enamel, special applicator, instructions, and two year guarantee . . . 70/-, post free. Sold only by Pacific Auto Supplies. You can now paint your car with a showroom like mirror finish for only 70/-. **Send Today. POST COUPON NOW.**

ELECTRIC ENGRAVER

Operates from any 6 or 12 volt car batt
Low battery consumption. Engraves on a
metals. Engrave your name on your own
for your protection against theft. Also engr
name or fancy designs on cigarette c
silverware, brooches, metal tags, etc. No
required to operate. Price 50/-, post fre

Engine Stethoscope

Locates and diagnoses engine faults by so
Amplifies sound 50 times. Indicates piston
faulty valves, bearing knocks, broken and
ball bearings, faulty gaskets, worn g
water pump faults, frozen shackles, b
squeaks, worn bearings and brushes in ge
ators, starters, and electric motors, etc.
locate faults in any machine having mo
parts. Simple to operate. Price £3/15/6,
free.

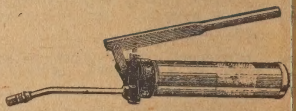
Screwdriver Set

Ingenious new screwdriver set. Does the
of five screwdrivers. Set includes five sc
driver blades of different widths, any of w
may be quickly inserted in the unbreaka
handle. Blade automatically locks in the han
Can be used on ordinary slotted head sc
and recessed screws. Suitable for any size
type of screw head up to ¼in diameter. In
pensable for motorists and mechanics.
strong and compact. Supplied complete
wallet. Price £1/6/6, post free.

Block Buster

Makes splitting blocks easy. This powerful
will split tough or curly grained hardwood
an axe would fail to split. Its wedge-sha
blade splits the wood without sticking or j
ming. It won't jam in the wood like an
Save time and energy with a blockbu
Makes your work easier on the wood he
Fitted with a genuine American hickory han
Weighs 6½lb. Price £2/2/-, forward on
Please state your nearest railway station.

HIGH-PRESSURE GREASE GUNS



An extremely powerful lever type grease
for cars, trucks, tractors and machinery.
gun exerts a pressure of 7500lb. Yes, it for
grease into the nipples at a pressure of o
3 tons per square inch. This means that
grease is definitely forced into every part
a bearing.
It is far more powerful than the ordinary t
of car grease gun. Soft, medium, and he
greases and oils can be used. This rugg
heavy duty grease gun is 18 inches in leng
and it's guaranteed for two years. Pr
£4/10/-, post free.

POST COUPON NOW!

PACIFIC AUTO SUPPLIE
47 McLeod Road, Carrum, Victoria.

Enclosed is .....
Please send immediately delivery th
following items:—

.....

.....

.....

0813

Please write in BLOCK CAPITALS

Name.....

Address.....

THE LIGHT THAT SAVES LIVES

(Continued from Page 17)

bull's eye" lens. Located around his lens above and below are further systems of prisms which collect ll the rays coming from the burner, efract them, and reflect them from he rear surface of the prisms, finally merging into a parallel beam of ght of great intensity.

This complicated system of prisms eighing perhaps 10 tons revolves round the light source which is ounted on a pedestal in the centre the lens system.

MERCURY BATH

In the case of a revolving lens he whole is sometimes mounted in bath of mercury and is so finely alanced that it is possible to turn with a touch of the finger. These re usually turned by an electric otor with a clockwork mechanism s a standby in case of failure.

Other types of revolving lenses e mounted on wheels, and the lens turned by a large clockwork type mechanism which uses a weight nning down the centre of the wer. These have to be wound up hand every hour or so unless ere is other mechanical means ovided.

Some of these lens systems are out 9ft in diameter, and as a stimony to their accuracy to which ey must be made, the prisms are st moulded, ground to extremely he limits and polished to a degree hich is unbelievable unless seen. efficient are these prisms as colctors of light that no light can be en through the back of the dioptic reflector no matter what the wer of the lamp.

In the higher power lighthouses metimes two, three or four lenses e superimposed, one above the her, with a burner at the centre each resulting in a light of double quadruple intensity. At times e downward light of the main rner is used to illuminate a ngerous shoal by directing the ht through an independent series prisms out of a low window.

There are lighthouses which transt colored beams for a variety of asons and some which have alterting colored and white light.

In order to allow for the different tensities between colored and white hts the lenses are connected.

There are some places where a hthouse would not be necessary t it is desired to have a warning ht of some kind. These lights or acons are usually powered with s either by an automatic acetylene nerator or from gas cylinders.

In order to avoid the necessity constant attention these lights e turned on and off by an autotic gas valve. This depends for generation on the fact that a ck object absorbs more heat than light colored body.

The apparatus consists of two ss globes, one black and the other ht in color. These are connected gether at the base by a tube. After ing exhausted of air the tube is partly filled with any highly-volatile liquid. such as ether.

When daylight comes the temperature of the black bulb is raised because it absorbs heat, while the temperature of the clear bulb remains at a lower temperature because it reflects the heat. The higher temperature of the black bulb vaporises the ether, and because of the increased pressure the ether is forced into the clear bulb. This greater weight overbalances the stand on which the bulbs are mounted and operates as a gas valve. In the case of an electrical installation it operates a switch. In both cases the light is switched off when daylight comes.

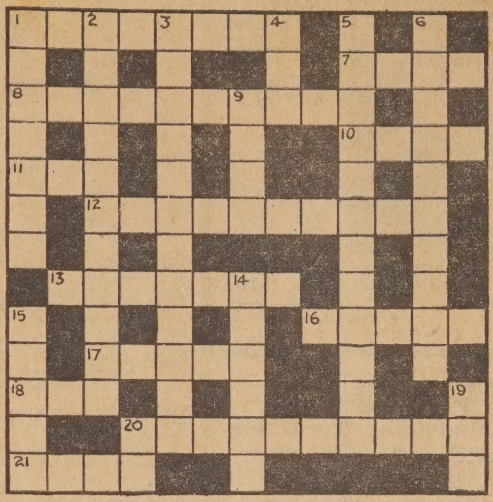
When darkness approaches or clouds or a heavy storm obscures the sun, the two bulbs attain an even temperature and the carriage rocks back into a balanced position, thus switching the light on.

It will thus be seen that a lighthouse is a most intricate mechanism and not "just a light" as is imagined by the public at large.

The lens system alone is a most costly affair and a job of great precision, calling for the highest skill of the lens maker and of the glass manufacturer.

Many lighthouses today are equipped with radio beacons in addition to lights. These radio beacons send out impulses which guide ships through thick fog and in darkness; but that is another story.

THE R. & H. CROSSWORD No. 9



ACROSS

1. Type of coil.
7. Rare gas.
8. Additions to telephone circuit.
10. Recording medium.
11. Source of many metals.
12. Old form of chemical rectifier used in battery chargers.
13. Slow battery charge.
16. Random (capacitance).
17. Place.
18. Indicate circuit junction.
20. German radio manufacturer.
21. Racial group.

DOWN

1. A compound (multi-purpose).
2. Multi-strand wire.
3. Type of resistor.
4. Double (abbrev.).
5. Placing in position.
6. Compact type of antenna.
9. Used in transformer cores.
14. Tarry.
15. Used for wartime communication.
19. Unity.
20. Television (abbrev.).

Solution and further crossword next month

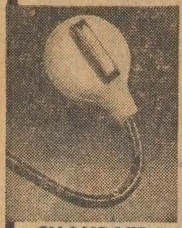
Solution to Puzzle November Issue

F	R	E	Q	U	E	N	C	Y		P	M	G
A		U		N		R		O		R		
D	I	R	E	C	T	I	O	N	A	L		I
E		N		E		O			E	N	D	
S	Y	N	C	H	R	O	N	O	U	S		
			H				E		S			
	S		I	N	T	E	R	V	A	L	V	E
P	H	O	N		E			E		A		D
	E		G		T			R		Z		I
E	L	E	C	T	R	I	C	I	T	Y		S
	L		O		O		R		U			O
	A		I		D		S	C	R	E	E	N
	C	A	L	L	E	D			N			

Full or Part Time. Genuine money-making plans. Write for free details, J. O'ROURKE, Director, Profitable Enterprises (Reg.), Desk RH.1 Box 5070, G.P.O., Sydney.

AWA RONETTE

MICROPHONES & ACCESSORIES



Type K407

£2/9/1

Contact microphone for attachment to musical instruments — also used as throat microphone.

CHANDLERS PTY. LTD.

ALBERT & CHARLOTTE STS., BRISBANE

and leading wholesalers

Precision Turned Aluminium Turntables and Shaft Complete

Drop in replacement for MU14 and GU4 B.S.R. motors. Eliminates wow and flutter.

£6/7/6, postage 8/6

Bearing can be supplied for above at 15/- each.

Agents for Crystal High Frequency Speakers.

A. F. KNOWLES

149 Union Rd., Surrey Hills, E.10, Vic. Phone WX3602.

HOBBY BOOKS ! !

I have just returned from Europe, and have piles of hobby books. Tell me what your hobby is, and I'll send you a list. By arrangement with the leading overseas publishers I can get you any book or magazine published. Please enclose stamped envelope.

JACK KERNOHAN,

5 LORNE STREET, CARNEGIE, MELBOURNE.

WANTED TO BUY SELL OR EXCHANGE

FOR SALE: Two small receivers, 1 B/c only and one B/c S/w with 4 plug-in coils, box of useful parts, ideal lot for young experimenter. Price £13, including set of batteries and phones. **Jones, 6, Powell St., Mount Gambier, SA.**

FOR SALE: Byer motor, £30; Leak Pickups, diamond stylii, LP, £20; Standard, £18; R. & H. Tuner, power, £15. **XM3712.**

ALL Back Issues of R. and H. for sale, in excellent order from **T. Weir, 73 Gibson Av., Padstow.** 4/- per copy, incl. post anywhere. Write for copy circuit article, etc., required. Inquiries welcome, **UY8056.**

SELL: 120X in Vented Encl. and OP112 to match, £20. **UM6828.**

SELL: Hemmi Elect. Slide Rule; No. 153. Original case, £4. **UM6828.**

SELL: Ham gear FS6 trans., &c. No reas. offer refused. **20 Atkins Rd., Ermington.**

SELL: Recorder BRS 2-speed with play-back PU. Best offer. **J. Wright, Box 3, P.O., Whittlesea, Vic.**

SELL: R. & H. from inception to end of 1952. Apply **30 Wood St., West End. Brisbane.**

SELL: Tape Recorder motors, BSR 4-pole, complete with idler wheels and pulleys, brand new, £2/10/- ea. **6 Edgar St., Auburn, NSW.**

SELL: 2 5BP1's, socket and mu-metal shield. Speaker—Rola G12, Field winding, 1000 ohms. **7 Bayswater Rd., Croydon, Victoria. Phone 91.**

SELL: Complete Tape Recording equipment, including vent. enclosure, 59 guineas. Write for Photo, &c., **H. Smith, 38 Marley St., Sale, Vic.**

SELL: Printing Press, Adana No. 2. New condition, plus type, &c. Nearest offer to £25. **B. Clarke, Chetwynd East, via Casterton, Vic.**

SELL: BC348, communcations, as new, extra output, high RF gain, "S" meter, converted 240v AC. **A. Shaw, P.O., S. Brisbane. J6526.**

SELL: Nova Flash Gun, £6; Bertram Amateur Exposure Meter, £6; Metal Tripod with pan-tilt head, £6; Agfa Flash Gun, £5; Crystal Mike with stand, £4. Particulars and offers, **D. Lehmann, ANZ Bank, Broken Hill.**

SELL: Qty. Collaro U506 240v mag. pick-up Record Players, direct drive, speed control. Also Col. RP49 Xtal pickup record players, rim drive, in original cartons, 30/- each. **11-17 Dixon St., Sydney.**

PRINTING Business Cards, 15/- per 100. Letterheads, cards for all occasions. **20 Badgery Av., Homebush. UM9944.**

MECCANO PARTS: Large stock g used parts below half list price! W for catalogue, **Taylor, 313 President A Miranda, NSW.**

SELL: 4-watt amplifier and spkr. G10 PU, £1; R. & H. Tape Adap No. 2, £5; Carry Set, £5; BSR 3-spe Player, 30/-; 2 8in spkrs., 20/- ea.; voltmeter, 10/-; 2 LP and STD Heads GP20 PU, 30/- ea.; Multimeter, 50 Also large quantity of Radio Parts. M sell. Best offer, **C. R. Douglass, Tiral Charlestown.**

SCHOOLBOY just discovering ra wants to buy unwanted parts cheap **FM1971 after 6pm.**

LEARNING young lad would much preciate unwanted radio parts. **Sievers, 23 Rusden St., Elsternwick, Me**

RADIO ACCESSORIES

We specialise in Radio Parts and stock all reliable brands. We can supply: Coils, I.F.'s, Transformers, Resistors, Tubular Condensers, Valves, Wires, Flex, Meters, Testing Equipment, Radio Manuals, Irons, Toasters, Pressure Cookers, Jiff Toasting Irons, Trimmers, Padders, Gang Condensers, Motors and Pickups, Record Changers, Cabinets, Solder Irons, Solder and Electrical Accessories, 4 and 5 Valve Mantel Sets — Portable Sets, Console Radio and Radiogram, etc. Mantel, Console and Radiogram Cabinets. TECNICO Electric Lawn Mowers, Floor Polishers and Vacuum Cleaners. 2 and 3 Speed Motors and Turntables. G.P.20 Pickups and Microgroove Heads.

DAVIS RADIO CO.

Wholesale Radio Distributors,

1st Floor, Wembley House, 841 George St., Sydney

NEXT GLACIARIUM

Phone M3917 **OPEN SATURDAY MORNINGS**

CALIBRATING YOUR R/C BRIDGE

(Continued from Page 81)

To commence the calibration, y will need a certain number of l tolerance resistors of appropria values to enable a sufficient numb of points to be identified on t scale. Unfortunately, it is not p sible to mark a few widely separat points and interpolate for the inte mediate positions, although this w be permissible between certain ma scale markings.

As a guide, suggested resistan values would be a 5 ohm, 2 ea of 10 ohms, 30 ohms and 50 oh and 2 each of 100 ohms, 300 ohms a 500 ohms. With these it is possib to make up resistance values betwe 5 ohms and 100 ohms in 5 ohm ste between 100 ohms and 300 ohms 10 ohm steps and between 300 oh and 1000 ohms in 50 ohm steps.

With the range switch set to t "100 ohm" range, use the resistan values between 5 ohms and 100 oh to mark the scale from .1 to 1 steps of .05. Portion of this ran can be interpolated to read in ste of .01 up to say .3.

With the range switch still in t "100 ohm" position, the same res tors can be used to calibrate t scale from .01 to .1 in steps of .01.

The intermediate markings w have to be calculated by dividi the desired figure into 1 and fin ing this point on the resistance sca to transfer the mark on to the ca acitance scale.

When the scale is completed a fitted to the panel again, the kn should be secured to the ratio po entiometer shaft so that the poin coincides with the markings prev ously roughed in.

REFERENCES

1. For a complete discussion this, see "Radio Receiver Design", K. R. Sturley, pp 274-280.

2. F. E. Terman, Radio Engineer Handbook, pp 649-652.

3. Keith Heeney (Ed.) Radio E gineering Handbook, pp 213-215.

Printed and published by Associat Newspapers Ltd., at the registered offi of the company, 60-70 Elizabeth Stree Sydney, NSW.